TEST GEAR

G QUIRK

DAWE Electronic
instruments

IB 741

3 - 9/63

OPERATING INSTRUCTIONS

FOR

REMSCOPE

TYPE 741

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1. SCHEDULE OF PARTS

One	-	Remscope Type 741
One	-	English Electric Storage Tube Type E702A
One	-	Tube Retaining Bracket (to be removed before operation).
One	-	Voltage Selector Plug (packed behind Tube Retaining Bracket).
Two	-	6ft coaxial leads each with a crocodile clip fitted at one end and an Amphenol plug fitted at the other end.
Two	-	Graticule Rules.

2. ACCESSORIES

Trace Shifter Y Amplifier	Type 741/1
Beamswitch Y Amplifier	Type 741/2
Single Ended Y Amplifier	Type 741/3
Remscope Trolley	Type 741/5
Probe	Type 741/6

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3. INTRODUCTION

3.1. The Remscope Type 741 storage oscilloscope is a special purpose oscilloscope for the study of fast transients.

The oscilloscope employs a cathode ray tube which will store and display single transients for long periods, thus eliminating the need for photography.

3.2. Plug-in Units

The following plug-in units are available:

Single Ended Y Amplifier with Trace Shifter Type 741/1
Beamswitch Amplifier Type 741/2
Single ended Y Amplifier Type 741/3.

3.3. Triggering

Triggering may be from an alternating or a changing d.c. source, the time base starting when the input exceeds a pre-set voltage. Repetitive, single shot (with lock out) or free running operation can be selected and triggering may be from a positive or negative signal. Great care has been taken to ensure absolute reliability of triggering.

3.4. Mechanical

Attention has been paid in laying out the instrument to ensure reliability and easy access should servicing be necessary.

3.5. Accessories

Trolley Type 741/5
Probe Type 741/6.

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4. WARNING

THE CATHODE RAY TUBE IN THIS INSTRUMENT MAY BE DAMAGED IF IT IS LEFT WITH A STATIONARY BRIGHT SPOT ON THE SCREEN.

THE TUBE MAY ALSO BE DAMAGED BY A REPETITIVE TRACE AT HIGH BRIGHTNESS.

IT IS STRONGLY URGED THAT WHEN THE INSTRUMENT IS OPERATED IN WHAT IS REFERRED TO IN THE FOLLOWING PAGES AS THE "NORMAL SCOPE CONDITION", i.e. SWITCHED TO "STORE" AND WITH A REPETITIVE TRACE, THE BRIGHTNESS SHOULD BE AS LOW AS POSSIBLE (PREFERABLY IN A DARKENED ROOM) AND THE TIME FOR WHICH A PARTICULAR TRACE IS REPEATED SHOULD BE AS SHORT AS POSSIBLE.

FAILURE TO OBSERVE THIS WARNING MAY RESULT IN A SPOT OR TRACE BEING "BURNED-ON" TO THE STORAGE MESH WITH SUBSEQUENT LOSS OF SENSITIVITY. IN CERTAIN INSTANCES IT MAY APPEAR THAT THE MESH IS DAMAGED WHEN IN FACT IT WILL RESPOND TO REMEDIAL TREATMENT. THIS REQUIRES SIMPLY THAT THE TUBE IS "CLEARED" AND ALLOWED TO OPERATE AT THE FULL BACKGROUND BRIGHTNESS FOR A FEW MINUTES.

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5. INSTALLATION AND INITIAL ADJUSTMENTS

5.1. Preliminary Examination

In view of the nature of the instrument it is strongly recommended that it be thoroughly inspected before putting into service to prevent faults consequential from mechanical damage in transit.

After unpacking, check that there are no external signs of damage. Remove the side covers and check that all valves, plugs and sockets are firmly in place and that no damage has occurred.

Should there be any doubt as to whether the instrument has arrived intact do not switch on but contact the manufacturer or your local agent.

Ensure that the plug-in unit is plugged in and screwed firmly in place by means of the knurled chrome headed screw at the bottom centre of the plug-in unit.

5.2. Special Warning - Handling of E.702A Storage Tube

The E.702A Storage Tube used in the Remscope must be handled with care during fitting or removal.

In particular it should be transported with the face upwards and under no circumstances should it be inverted from this position.

Failure to observe this precaution may result in permanent damage to the tube.

5.3. Fitting Instructions (Tube already fitted)

Normally instruments despatched to the home market will have the cathode ray tube fitted and connected, but there will be a metal bracket supporting the tube and mu-metal screen which must be removed before switching on the mains.

Remove the left hand side cover and remove the two 4BA screws which secure the bracket supporting the tube and mu-metal screen. Under this bracket will be found a bag containing the voltage selector plug. This should be inserted into the voltage selector panel on the rear of the instrument after checking the mains voltage.

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5. INSTALLATION AND INITIAL ADJUSTMENTS (continued)

The voltage selector panel will either cover the range 100-125V at 60c/s or 200-250V at 50c/s.

Check that the MAINS and H.T. fuses are the values marked on the rear panel of the instrument.

5.4. Fitting Instructions (Tube despatched separately)

Instruments despatched to overseas may have the tube packed separately in its original carton.

Remove the left hand side cover, remove the 4 chrome knurled screws which hold the tube graticule and mask to the front panel. Check that the alignment of the two mu-metal screens is correct with respect to the aperture in the front panel.

The tube should now be removed from its carton and slid into the mu-metal screens taking care not to knock the E.H.T. screen connection block on the side near the tube face. The tube should be inserted so that the tube face is flush with the front panel of the instrument and the graticule and mask refitted.

The E.H.T. screen connection should be connected to the wander socket on the Tube Circuit B printed circuit. The 3 side caps should now be connected, these being identified by colour of the cap and that painted on the mu-metal screen holes. The tube base should now be fitted with care.

The bag containing the voltage selector plug will be found tied to the strap securing the rear portion of the mu-metal screen. This should be inserted into the voltage selector panel on the rear of the instrument after checking the mains voltage.

The voltage selector panel will either cover the range 100-125V at 60c/s or 200-250V at 50c/s.

Check that the MAINS and H.T. fuses are the values marked on the rear panel of the instrument.

5.5. Mains Plug

A Bulgin SA.1393 mains input connector will be found in the kit of accessories supplied with the instrument. This connector should be fitted with a suitable mains lead.

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5. INSTALLATION AND INITIAL ADJUSTMENTS (continued)

5.6. Initial Adjustments - Main Unit

Set the controls as follows:-

Beam Cut Off	One full division from fully clockwise.
Bright Up Level	Fully anticlockwise.
Background	Fully anticlockwise.
Focus	Mid position.
Read - Store	Store
Clear - Erase	Mid position.
Time/cm	10ms
Multiplier	X1
Normal - Lock Out - Prime	Normal
Threshold	Fully clockwise
X Shift	Mid position
Level	Mid position
Int. ± / Ext. ±.	Int +
Free - AC - DC	Free

5.7. Initial Adjustments - Plug in Unit

Trace Shifter Y Amplifier Type 741/1

Y Shift	Mid position
Cal - Zero - DC - AC	Zero
Volts/cm	.5
Traces	Off

Beamswitch Amplifier Type 741/2

Channel 1	Y Shift	Mid position
	Cal - Zero - DC - AC	Zero
	Volts/cm	.5
Channel 2	Y Shift	Mid position
	Cal - Zero - DC - AC	Zero
	Volts/cm	.5

Common Controls

Int. Trig 1/2	1
Channel Selection	1

Single Ended Y Amplifier Type 741/3

Y Shift	Mid position
Cal - Zero - DC - AC	Zero
Volts/cm	.5

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5. INSTALLATION AND INITIAL ADJUSTMENTS (continued)

5.9. Further Adjustments

Connect the mains supply to the instrument and set the MAINS switch to ON, the mains indicator lamp will then glow red. Allow 30 seconds for the instrument to become operative. Advance the BRIGHT UP LEVEL control until a trace is just visible. Operate Y SHIFT and X SHIFT as required to position trace in centre of screen.

Rotate the THRESHOLD anti-clockwise to a point just before the trace ceases. This is the correct setting for the THRESHOLD control and the trace should be visible.

Switch the Y amplifier input from ZERO to CAL and a 50c/s square wave should be observed. Adjust the FOCUS control for optimum display.

Switch the Y amplifier input to AC or DC as required. The basic control settings are now suitable for use as a normal oscilloscope, fuller details of the use of the controls common to all modes of operation are given later.

Switch the SWEEP to the LOCKOUT condition and set the STORE/READ switch to READ.

A bright fluorescence filling all the screen will probably be obtained. This is quite in order and no damage to the cathode ray tube will result due to this condition.

Switch the ERASE/CLEAR switch to CLEAR for 1 second approx. and then to the ERASE position for 3 secs. approximately.

The screen should return to some level of overall brightness and this should be adjusted with the BACKGROUND control until the background fluorescence is just visible.

Switch the Y amplifier to CAL and then switch the SWEEP to PRIME. A display of a 50c/s square wave should be observed. If this is too bright or very faint adjust the BRIGHT UP LEVEL control and repeat the ERASE/CLEAR procedure until a satisfactory display is obtained.

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5. INSTALLATION AND INITIAL ADJUSTMENTS (continued)

The background fluorescence will now rise over a period of about 10 minutes to obliterate the stored waveform.

The waveform may be retained without deterioration by switching the READ/STORE switch to STORE.

If a signal is written repetitively on the storage mesh either in the READ or STORE condition the brightness of the stored signal will be proportional to the total number of sweeps written. If this number is excessive the charge will spread across the surface of the mesh causing the screen to be filled with a bright fluorescence.

A similar effect will result from a stationary bright spot which will damage the screen.

It is not possible to leave a signal stored while continuously writing in the STORE condition as when operating the Remscope as a normal oscilloscope.

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6. OPERATION

6.1. Main Unit.

6.1.1. General

In the following section appear operating instructions which in general apply to the use of the Remscope either as a normal oscilloscope or as a storage oscilloscope. It is suggested that the control adjustments are tried under normal oscilloscope conditions so that the user may gain familiarity with their settings. It is strongly recommended that the trace brightness as a normal oscilloscope should be the absolute minimum to avoid damage to the storage mesh. To this end, the familiarisation would best be performed in a darkened room.

6.1.2. Beam Cut-Off

This controls the operating conditions of the cathode-ray tube and is normally set in the factory so that the beam is just extinguished with the control set almost fully clockwise. Clockwise rotation of this control increases the brightness of the beam.

If a bright stationary spot appears on the screen this control should be adjusted in the anti-clockwise direction until the spot disappears. It will be necessary in the READ condition alternately to erase the spot and adjust the BEAM CUT-OFF control during this operation as the oscilloscope will be storing the picture. When this setting has been found, finally erase the tube and no spots should appear on the screen. (See Section 8.1.(d)).

6.1.3. Bright Up Level

This controls the amplitude of the BRIGHT UP fed to grid of the cathode ray tube. The amount of BRIGHT UP required will depend on the sweep speed and should be set just to provide sufficient trace brightness. The control must be rotated clockwise with increasing sweep speeds to provide sufficient BRIGHT UP. Do not advance the BRIGHT UP LEVEL to write heavily otherwise difficulty in erasing will be experienced.

6.1.4. Background (Operative in Read condition only)

This controls the level of the background fluorescence enabling the user to obtain optimum display conditions. Care must be taken not to advance this control too far as erasure may take place. If it

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6. OPERATION (continued)

it is turned clockwise until the screen is brightly lit and left for about 3 seconds before returning to the original setting erasure will be complete.

If, however, the time during which the screen is brightly lit is curtailed the brighter portions of the written trace will be reduced in intensity. This may facilitate the study of a signal with a wide contrast range. It may be found after a number of operations that the BACKGROUND control has, of necessity, been moved from its normal central position. When this is observed, the control should be centralized prior to the next CLEAR/ERASE operation.

6.1.5. Focus

This controls the sharpness of the trace and focusing may be carried out when using the instrument as a normal oscilloscope with a repetitive signal of low brightness. Variations of focus may occur with variations of time-base range and between READ and STORE conditions, especially on faster ranges.

6.1.6. Read/Store

In the READ condition the Remscope is in its storage and display condition. Any signal fed to the Y amplifier will be stored and displayed at once.

A rise in background level will commence as soon as an erasure has taken place regardless of whether a signal has been written on the screen or not. It is therefore recommended that the erasure takes place just prior to storing a signal.

The time taken for the background to rise to a level where the signal is obliterated is approximately 10 minutes.

If the READ/STORE switch is set to STORE this rise in background level will not occur, thus when it is required to store a signal without displaying it the instrument should be set to STORE. By switching to READ the stored signal may be observed at any time.

The instrument may be used as a normal oscilloscope when switched to STORE but stored information will be eliminated due to charge spreading across the surface of the storage mesh. However, see the warning in Section 4.

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6. OPERATION (continued)

6.1.7. Clear/Erase (Operative in Read condition only)

The CLEAR position takes the background up to a high level of fluorescence eliminating all stored information. This occurs for a period depending on the discharge of a capacitor and will not exceed 10 milliseconds.

The switch should then be set to the ERASE position which reduces the background level preparing the tube for the next transient. The switch should be held in the ERASE position for about 3 seconds.

6.1.8. Time/cm

This switch controls the time base velocity in decade steps.

6.1.9. Multiplier

This allows the time base velocity to be continuously variable, multiplying the time set on the TIME/cm switch by between X1 and X5. This control is calibrated at X1. It is recommended that for accurate intermediate settings the internal calibration waveform (at mains frequency) should be used.

6.1.10. Sweep Controls

(a) Threshold

The control sets the minimum level of signal which will trigger the sweep generator.

If this control is advanced too far clockwise the sweep generator may free run unless it is set to LOCK-OUT.

To adjust for maximum trigger sensitivity set the TRIGGER switches to INT + and FREE, the TIME/cm to 100μs/cm, the SWEEP control to NORMAL and advance the THRESHOLD control until the sweep generator just free runs. If less sensitivity is required the setting may be altered in the presence of a triggering signal.

(b) Normal/Lock Out/Prime

This switch controls the type of sweep obtained.

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6. OPERATION (continued)

In the NORMAL condition the sweep generator is either free running or repetitively triggered depending on the position of the TRIGGER switches.

In the LOCK OUT mode the time base is prevented from operating under any circumstances. This condition is provided to prevent unwanted traces being produced while making adjustments or connections.

The PRIME position allows the LOCK OUT condition to be over-ridden and allows the sweep generator to do one single sweep. This switch is biased to return to the LOCK OUT position and each time a sweep is required the switch must be depressed to the PRIME position. This facility can be used when a single shot record of a repetitive signal is required.

The sweep generator will respond to the first trigger received after depressing the switch to the PRIME position.

6.1.11. X Shift

This control moves the trace horizontally and will move the start or finish of the trace to about the centre of the graticule. Clockwise rotation moves the trace to the right.

6.1.12. Trigger Controls

(a) Int. Ext. Switch and Probe Test

The switch selects the source and type of triggering signal.
The INT. + or - positions allow the sweep generator to be triggered either from the positive or negative edge of a signal derived from the Y amplifier.
The EXT. + or - positions allows the sweep generator to be triggered either from the positive or negative edge of a signal which is fed into the TRIGGER INPUT socket.
The TEST PROBE position of the INT. EXT. switch provides a 5 volt 1kc/s square waveform at the PROBE TEST socket, which facilitates adjustment of the 10:1 Attenuator Probe obtainable as an accessory to the instrument.

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6. OPERATION (continued)

(b) Free AC, DC.

In the FREE position the sweep generator will free run and may be synchronised by the signal which is selected by the INT./EXT. switch. In the AC or DC positions the sweep generator will operate in a triggered mode.

(c) Level (Inoperative on the FREE position)

This controls the voltage level at which the sweep is initiated. In effect this control selects a voltage slice from the trigger signal input and feeds it into the triggering circuits. The level of the slice is controlled by the LEVEL setting. This control is non-linear in operation, the first 45° of rotation from centre position in either direction corresponds to about 5 volts.
This is deliberately arranged as it facilitates adjustment on small trigger signals.

6.1.13. Sweep In Terminal

This is normally connected to earth via a link (supplied with the instrument) when operating with the internal sweep generator. If it is required that an external waveform should deflect the trace horizontally then the link should be removed and the waveform connected to the SWEEP IN socket. The NORMAL/LOCK OUT/PRIME switch should be set to LOCK OUT.

A negative going waveform will deflect the spot from left to right and the terminal is d.c. coupled into the X amplifier.

6.1.14. Gate Out Terminal

This provides a negative going square wave co-incident with the sweep.

6.1.15. Retaining a Signal with the Mains Switched Off

Owing to the nature of the storage tube used in the Remscope it is possible to store a signal which has been written on the storage mesh without keeping the power supplies switched on.

This prolongs the life of the storage tube.

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6. OPERATION (continued)

To ensure that the signal is retained without having any spurious deflections superimposed on it the following procedure should be carried out.

1) Switch SWEEP to LOCK OUT
2) Switch STORE/READ to STORE
3) Turn BEAM CUT-OFF fully anticlockwise.
4) Switch MAINS to OFF

The instrument should not now be switched on again until a time of at least 60 seconds has elapsed.

6.1.16. To View Image Again

5) Switch MAINS to ON with all other controls as they were left in switching off.
6) Wait 30 seconds.
7) Switch STORE/READ to READ
8) Advance the BACKGROUND control until the image is displayed.

6.2. PLUG-IN UNITS

6.2.1. Trace Shifter - Y Amplifier Type 741/1

(a) General

This is a d.c. coupled general purpose amplifier with a sensitivity of 100mV/cm to 50V/cm which may be a.c. or d.c. coupled at the attenuator input.

This amplifier also incorporates automatic Y shift which takes place after each sweep of the time base. The number of steps of Y shift may be 2, 4 or 8 but in the OFF condition no automatic shift takes place.

(b) Y Shift

This control positions the trace (or traces with automatic Y shift) vertically on the screen. Clockwise rotation moves the trace upwards and sufficient shift voltage is provided to move the trace at least one screen diameter.

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6. OPERATION (continued)

(c) Cal/Zero/DC/AC.

The DC and AC positions of this switch control the type of coupling from the SIG. IN socket to the attenuator.

The DC position allows direct coupling into the attenuator whilst in the AC position a capacitor is introduced between the SIG.IN socket and the attenuator. The maximum input should not exceed 500 volts. The ZERO position open circuits the SIG. IN socket and connects the attenuator input to earth. This allows the trace to be set to ZERO when making d.c. level measurements.

The CAL position connects a 50c/s 0.6^{V} square wave into the attenuator input to allow the Y amplifier gain to be checked.

(d) Volts/cm

This selects the attenuator range required for obtaining suitable Y deflection amplitude and in the 0.1V/CM position the SIG. IN socket is directly coupled without attenuation to the amplifier input.

(e) Traces

This switch controls the operation of the automatic Y shift and in the OFF position the automatic Y shift is inoperative. The 2, 4 and 8 positions select the number of traces to be displayed. Some adjustment of the Y shift may be required to centralise the traces on the screen.

(f) Reset

The RESET button allows the traces to be reset to start at the top of the screen.

6.2.2. Beamswitch Y Amplifier Type 741/2

(a) General

This is a d.c. coupled 2 channel switched amplifier which may be used with CHANNEL 1 or CHANNEL 2 separately, or with both channels together.

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6. OPERATION (continued)

Each channel has a sensitivity of 100mV/cm to 50V/cm and may be a.c. or d.c. coupled at the attenuator input..

Triggering signals may be selected internally from either channel to trigger the sweep generator.

(b) Y Shift (Channels 1 and 2)

These controls position both the traces vertically on the screen in the 2 channel mode of operation and in the single channel mode the Y SHIFT control associated with the channel selected is used.

(c) Cal/Zero/DC/AC

The DC and AC positions of this switch control the type of coupling from the SIG. IN socket to the attenuator. The DC position allows direct coupling into the attenuator whilst in the AC position a capacitor is introduced between the SIG. IN socket and the attenuator. The maximum input should not exceed 500V. The ZERO position open circuits the SIG. IN socket and connects the amplifier input to earth. This allows the trace to be set to ZERO when making d.c. level measurements. The CAL position connects a 50c/s 0.6V square wave into the attenuator input to allow the Y amplifier gain to be checked.

(d) Volts/cm

This selects the attenuator range required for obtaining suitable Y deflection amplitude and in the 0.1V/cm position the SIG. IN socket is directly coupled without attenuation to the amplifier input.

(e) Channel Selection

This switch controls the mode of operation allowing either single trace or dual trace operation.

Position 1 allows Channel 1 to be operative and in this condition the amplifier may be used as a single channel amplifier with no switching taking place. Channel 2 should be set to ZERO in this condition and if internal triggering is required the INT. TRIG. should be set to position 1.

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6. OPERATION (continued)

Position 2 allows Channel 2 to be operative and in this condition the amplifier may be used as a single channel amplifier with no switching taking place. Channel 1 should be set to ZERO in this condition and if internal triggering is required the INT. TRIG. should be set to position 2.

Position 1 and 2 allows the amplifier to be operated as a 2 channel amplifier, switching between traces occurring during the trace sweep. Suppression applied during the switching keeps the noise on the traces to a minimum.

The sweep generator may be triggered from the signal fed to either channel by the INT. TRIG. switch.

(f) Int. Trig.

This switch selects triggering signals from either Channel 1 or Channel 2 feeding to the sweep generator when internal triggering is required.

6.2.3. Single Ended Y Amplifier Type 741/3

(a) General

This is a d.c. coupled general purpose amplifier with a sensitivity of 100mV/cm to 50V/cm which may be a.c. or d.c. coupled at the attenuator input.

(b) Y Shift

This control positions the trace vertically on the screen, clockwise rotation of the control moves the trace upwards and sufficient shift voltage is provided to move the trace at least one screen diameter.

(c) Cal/Zero/DC/AC

The **DC and AC positions** of this switch control the type of coupling from the SIG. IN socket to the attenuator. The DC position allows direct coupling into the attenuator whilst in the AC position a capacitor is introduced between the SIG. IN socket and the attenuator.

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6. OPERATION (continued)

The maximum input should not exceed 500V.

The ZERO position open circuits the SIG. IN socket and connects the attenuator input to earth. This allows the trace to be set to ZERO when making d.c. level measurements.

The CAL position connects a 50c/s 0.6V square wave into the attenuator input to allow the Y amplifier gain to be checked.

(d) Volts/cm

This selects the attenuator range required for obtaining suitable Y deflection amplitude and in the 0.1V/cm position the SIG. IN socket is directly coupled without attenuation to the amplifier input.

6.3. Probe

The Probe is plugged into the SIG. IN socket of the plug-in unit, then by applying the Probe Tip to PROBE TEST socket and switching the INT./EXT. switch to PROBE TEST the internal capacitor of the Probe can be set for optimum rise time.

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7. CIRCUIT DESCRIPTIONS

7.1. Tube Principles

How the Image is Stored

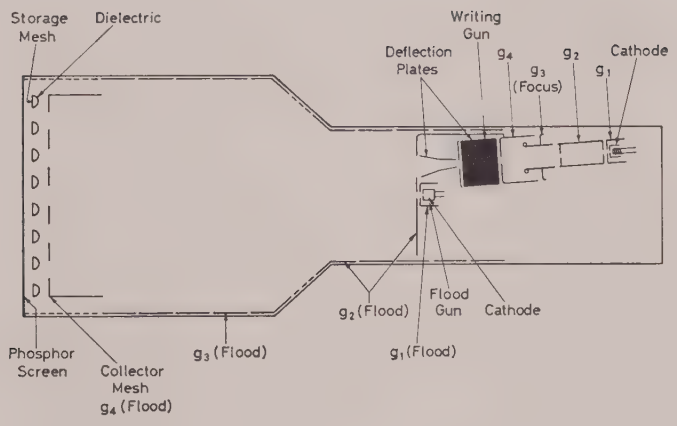

Fig. 1 English Electric Storage Tube Type E702A.

The E702A direct-view storage tube will store and display a signal for long periods. A simplified description of its mode of operation is given below.

The tube has two electron guns in its neck. One of these, called the writing gun, is of conventional design with a high velocity beam which is focused and deflected in the normal way. The second gun, the flood gun, is undeflected and produces a parallel beam of low velocity electrons covering the whole screen area.

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7. CIRCUIT DESCRIPTIONS (continued)

Between the guns and the fluorescent screen are interposed (going from neck to screen) a positively charged grid and the storage mesh which consists of a very thin deposit of excellent insulating material covering the gun side of a wire mesh backing electrode but leaving the openings in the mesh unchanged. In effect the storage mesh consists of a multiplicity of storage elements, each capacitatively coupled to the backing electrode. The insulator has secondary emissive properties.

Initially the storage grid is set at a negative potential which will cut off the flood gun electrons from the screen.

If, now, the high velocity electrons from the writing gun strike the storage mesh, secondary electrons will be emitted from it and attracted towards the collector mesh. The storage mesh will go positive in the written positions and allow flood gun electrons to pass to the screen and produce a fluorescence. The charge distribution is stored in the capacitance between the storage mesh and the backing electrode. This distribution is not disturbed by flood gun electrons owing to their low velocity. The presence of a high current electron beam (from the flood gun) in the tube produces positive ions in the residual gas and these ions drift towards the storage mesh. The collector mesh tends to repel many of these ions but some land on the storage mesh and neutralise the negative charge, so allowing penetration of flood gun electrons. The effect of these ions is to allow the background fluorescence gradually to rise and so set the limit of the display time. This may be delayed by pulsing the backing electrode and also by switching off the flood current (i.e. storing without displaying the signal).

Erasure of the image is accomplished by applying a positive pulse to the backing electrode allowing the storage surface to recharge uniformly from the flood beam.

On removing the positive pulse the storage surface is taken below flood gun cathode potential, thus cutting off the flood beam from the viewing screen.

7.2. Storage and Display

As will be gathered from the description of the cathode ray tube it is possible (by switching off the flood gun) to store the signal without displaying it. Under these conditions the storage time is only limited by the insulation resistance of the storage

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7. CIRCUIT DESCRIPTIONS (continued)

mesh and is of the order of one week. The signal may be viewed at any time during the storage period by switching on the flood gun and the total viewing time is of the order of 10 minutes (depending on the initial brightness of the written display).

7.3. General Arrangement

Reference should be made to the accompanying functional schematic diagram.

The writing gun of the storage tube is similar to that contained within a normal cathode ray tube, and the circuits associated with this part of the tube are similar to those encountered in any high grade measuring oscilloscope, with certain modifications in view of the particular application of the instrument in the study of transient waveforms. On the other hand the circuits associated with the flood gun and storage mesh are peculiar to this instrument and their mode of operation will be described in greater detail.

7.4. Arrangement of Writing Gun

The Y plates of the tube are driven from a push pull amplifier which is connected push pull from the plug-in unit cathode followers. The plug-in unit input socket is connected via an attenuator to the pre-amplifier in the plug-in unit. The sweep generator may be free running or synchronised, or triggered from an external source, or triggered from the plug-in unit amplifier.

The trigger shaper treats the incoming waveform for application to the sweep generator.

In normal application the sweep generator will sweep each time it receives a trigger pulse, this will cause many traces to be stored and there will be a confusion of superimposed stored traces on the screen.

To stop this effect a lock-out circuit may be switched in; when the prime button associated with this circuit is actuated one sweep will be executed upon arrival of the first triggering voltage to arrive after the circuit has been primed.

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

If any continually re-occurring voltage is fed into the trigger circuit under lock-out conditions, and the PRIME switch actuated, then that part of the signal waveform occurring within the duration of the sweep which follows will be stored.

The X amplifier is fed with the sawtooth waveform produced by the sweep generator and applied push pull to the X plates of the tube. The writing gun is normally cut off by making the grid negative to the cathode and the cathode is fixed at a stabilised potential of -800V. The grid is fed via a potential divider from a -1600V supply which has the positive going Bright Up fed to its earthy end. By this means the Bright Up pulse is d.c. coupled to the writing gun and will switch it on, maintaining constant brightness level regardless of sweep duration. The screen of the tube is maintained at a stabilised potential of 7.0kV which is also supplied from the common grid and cathode supply.

7.5. Arrangement of Flood Gun

The choice of relative electrode potentials is initially dictated by the potential of the deflector plates (+200V mean), as writing gun grid No. 4, which is connected to flood gun grid No. 2, is required to be at the same potential to correct astigmatism. The relative potentials of other electrodes follow as shown on the functional diagram.

For reasons described in Section 7.1. the background fluorescence will approach the intensity of the stored image after a while making the trace unreadable. In order to slow down the rate of increase of the background fluorescence short positive pulses are applied to the backing electrode via a mixing circuit. The unwritten elements of the tube are thereby kept negative and are in effect recharged to offset the discharge brought about by the positive ions.

By this means the trace may be read for about 5 to 10 minutes after writing. The average level of the background may be controlled by a potentiometer which sets the backing electrode potential.

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7. CIRCUIT DESCRIPTIONS (continued)

7.6. Tube Modes

7.6.1. Store

The signal waveform is retained on the storage mesh for a time limited only by the insulating properties of the storage mesh. y placing the STORE/READ switch into the STORE position the flood un cathode is changed from +100V to +200V effectively. cutting off the flood beam.

To avoid an unsafe potential being developed between the storage mesh and backing electrode under these conditions the backing electrode is taken up to +325V which sets it at the same potential as flood grid No. 4.

7.6.2. Read

When the STORE/READ switch is set to READ the flood gun cathode is set at +100V and the backing electrode at about +100V. The flood beam is now on and the trace may be stored whilst being continually read, the reading time being controlled by the persistence pulses.

7.6.3. Clear/Erase

Before erasing the tube will normally be in the READ condition with a trace being viewed.

On setting the CLEAR/ERASE switch to CLEAR the backing electrode is taken to +325V for a short time thus bringing all elements of the storage mesh to a uniform state of charge. As the switch is taken to the ERASE position the backing electrode returns to +100V , when the switch reaches the ERASE position the backing electrode is taken to +105V. On return of the switch to its normal position the backing electrode falls to +100V leaving the storage mesh at +5V with respect to the backing electrode hence cutting off the flood beam.

7.6.4. Normal Scope Operation (see Warning in Section 4)

The oscilloscope may be used with a repetitive signal in the stored condition providing due attention is paid to the warning in Section 4. Under these conditions the instrument will operate similarly to a normal oscilloscope.

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7. CIRCUIT DESCRIPTIONS (continued)

This repetitive writing should be kept at low intensity due to the possibility of damaging the mesh.

Some halo effect will be noticed due to secondary electrons being dislodged from the mesh.

7.7. Circuit Diagrams

The circuit diagrams have been drawn in two forms.

(a) Drawing No. E22740 and E22741 show the main chassis and its power supplies and if the left hand edge of the power supply drawing is aligned with the right hand edge of the Main Chassis drawing the whole circuit diagram is formed for the instrument.

The plug-in units drawing numbers are as follows:-

E22743 Trace Shifter Y Amplifier Type 741/1
E22744 Beamswitch Y Amplifier Type 741/2
E22742 Single Ended Y Amplifier Type 741/3

Any one of these may be aligned to the left hand edge of the Main Chassis drawing to show the interconnections between the Main Chassis and Plug in Unit.

(b) Drawing No. E22746 (2 sheets) shows all the individual printed circuits, mains transformer and front panel. The connections on each unit have their destinations shown and hence all interconnections between printed circuits, mains transformer and front panel are available. The operation of the units will be described with reference to drawings E22740 and E22741.

7.8. Power Supplies (E22741)

7.8.1. H.T. Rectifier and Stabiliser.

The mains supply is fed via a voltage selector panel to the mains transformer T.1. the primary of which is in two sections to allow connection in series or parallel for 200V range or 100V range working. The H.T. winding of T.1. feeds V1 and V2 which are full wave rectifiers working in parallel. These provide 650V to the stabilising circuit which is of the series type with V6, V7, V8, V9 as the series valves controlled by V5 providing +325V.

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7. CIRCUIT DESCRIPTIONS (continued)

RV1 controls the amount of hum which is fed to V5 to appear in its output to minimise the hum on the H.T. rails. The cathode of V5 is connected to the centre tap of the H.T. winding which is set at -200V by V10a which in turn controls V10b and hence V11, the -200V shunt regulator.

The +325 and -200V lines provide the bulk of the current to all circuits and the +325V line is referred to the -200V line by the neon V4.

On one half of the main H.T. winding is a tap at +275V which feeds a half wave silicon rectifier, the output of which is neon stabilised at -150V by V3 with respect to the -200V line thus forming a -350V line.

A -100V line is formed between the -200V line and earth by neon stabiliser V12.

7.8.2. Valve Heaters

The mains transformer supplies all valve heaters except those of the plug-in units.

All valve heaters have been taken to a suitable d.c. level to minimise heater to cathode leakage.

7.8.3. Calibration Waveform Generator

The L.T. heater winding also supplies a squaring circuit formed by diodes D3 and D4. Normally D4 is conducting, passing 2mA through R91 when D3 is non-conducting during the negative cycle. During positive cycle D3 conducts, turning off D4 and hence the 2mA. This produces an output of a squared sine wave of 0.6V amplitude at mains frequency and is fed to the plug-in unit for calibration purposes.

7.8.4. Plug-in Unit Heater Stabiliser

This provides a stabilised 44V supply to minimise Y amplifier drift due to mains variations. The mains transformer feeds via a bridge rectifier to a transistorised series regulator. TR1 is the series regulator and is controlled by TR2 and TR3. The emitter of TR3 is stabilised by the Zener diode Z1. The base of TR3 is controlled by RV30 to set the output voltage of this stabiliser and RV31 controls the regulation of the output.

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7. CIRCUIT DESCRIPTIONS (continued)

7.8.5. E.H.T. Oscillator and Stabiliser

V4 is an oscillator with an anode winding which forms the primary of a ferroxcube-cored winding. The secondary is split into 3 series sections with one end at OV.

The output of the first section is rectified by V17 to give -800V. The heater winding of V17 has series resistance to delay the rise of the 800V supply when switching on the instrument. This keeps the cathode potential of the C.R.T. above that of the grid thus preventing high writing beam currents when switching on the instrument.

The output of the second section is rectified by V18 which provides -800V with respect to the -800V provided by the first section. This is fed via RV4 and a potential divider (see Bright Up description) to the grid of the C.R.T.

The output of the last section is fed to the voltage doubler circuit of V16 and V17 which provides 7.0kV for the screen of the C.R.T.

The heater winding of V16 has series resistance to give a slow and steady rise of screen voltage when the instrument is switched on. The -800 volts supply is fed back via a potential divider to V13a which controls V13b which in turn controls the screen voltage of the oscillator V14. This controls the amplitude of oscillations and hence forms a stabilised supply.

7.9. Main Chassis (E22740)

7.9.1. Trigger Shaper

The trigger shaper is formed by V23 and V24, these valves processing the triggering signal for application to the sweep generator from either an external source or the plug-in Y amplifier.

V23a and V24a form a comparator with the grid of one of the valves connected to the trigger source and the other to a variable d.c. potential controlled by RV5 (Trigger Level). SWF controls the application of trigger signals and d.c. voltage to the grids of the valves to ensure that a negative edge is always produced at V24a anode.

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

This requires positive going edges to V24a grid and negative to V23a grid. The trigger voltage must exceed the d.c. level set on the other grid for the trigger to appear amplified at V24a anode. The negative going edge from V24a anode is now applied to V23b grid. V23B and V24b form a Schmitt squarer which is triggered from the negative edge at the grid of V23b. This results in a negative trigger edge at V24b anode which is then differentiated by C58, R123 for application to the sweep generator via D5.

In the free running condition V23b and V24b form a low frequency free running multivibrator due to the inter-grid coupling via R120 and SWG. Whenever a negative synchronising pulse arrives from V24a the oscillations are arrested and the circuit reverts to the mono-stable condition, providing one negative edge at V24b anode per synchronising pulse.

7.9.2. Sweep Generator

The sweep is controlled by negative triggers arriving at the grid of V25a from the trigger shaper. The potential on this grid is controlled by RV6 (sweep threshold) and is normally at about +10V with V25b grid at about OV. Thus V25a is on and the potential on its grid may be varied to give V25a a greater or lesser sensitivity.

Upon receipt of a negative trigger V25a is cut off and V25b is turned on, assisted by the cathode coupling between the valves. V26a was conducting with the timing capacitors in its cathode uncharged, the negative edge from V25b cuts V26a off.

The selected timing capacitor now charges negatively through V26b and the selected timing resistance on SWE. The rate of charging is controlled by RV8 (multiplier) which provides a continuously variable 1 to 5 multiplier.

The negative going sawtooth is fed back to the grid of V25b and when it reaches the potential on V25a grid, V25b turns off and cuts V25a on which in turn discharges the timing capacitor by turning on V26a.

The amplitude of the sawtooth waveform is controlled by the potential of V25a grid when it is negative during the sweep time. When V25a grid goes negative at the start of a sweep it is clamped by D6 at a level determined by the RV13 (sweep amplitude) with V28a conducting.

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

The capacitors on the grid of V25a slow down the fall of V25a grid at the end of a sweep to give the timing capacitor time to discharge before starting another sweep. This ensures that the sweep always starts from the same level and hence the same point on the tube face.

The negative going sawtooth is fed out to the X amplifier via the cathode follower V27a.

The positive going square wave produced at V25a anode which is the duration of the sweep is fed to the Bright Up circuits via the cathode follower V27b.

7.9.3. Normal, Lock Out Prime

In the NORMAL position of SWD (NORMAL/LOCK OUT/PRIME)the grid of V29a is taken to negative 130V thus cutting it off, leaving V28a on, and via D6, V25a grid is held at about 15V positive leaving V25a on and responsive to trigger signals, hence allowing normal operation of the sweep generator.

When SWD is set to LOCK OUT, V29a grid is taken to negative 120V and V29a is on, turning V28a off. This takes the grid of V25a via D6 to about +25V making V25a insensitive to the negative trigger pulses.

When SWD is depressed to PRIME a negative pulse formed by discharging C80 is applied to V29a grid, turning V29a off and V28a on. This allows V25a grid via D6 to return to +10V and hence become sensitive to trigger signals. The first trigger pulse arriving allows the sweep generator to execute a sweep. At the end of the sweep the negative going edge at V27b is fed through the differentiating circuit at C87 R158 via D8 to turn V28a off and hence V29a on. This immediately takes V25a grid up to +25V, thus making it insensitive to further trigger signals.

7.9.4. Bright Up

The square wave sweep duration is taken from V27b cathode via D9 to the grid of V30b. V30a grid is controlled between +200V and +150V by RV14 (Bright Up Level) and this level appears on the cathode of D12. This level controls the amount of the square wave which passes through D9 to V30b grid. The square wave on the cathode of D9 is positive at +200V during the sweep coming from +150V during

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

sweep interval. Thus D9 will only conduct when the square wave is below the voltage set on D9 anode, thus it limits the amplitude of the square wave appearing at V30b grid.

This square wave appears on the cathode of V30b and is added to the earthy end of the -1600V which controls the grid of the C.R.T.

RV15 (Beam Cut Off) allows the actual d.c. level of the C.R.T. grid to be set before Bright Up is applied.

7.9.5. X Amplifier

The sawtooth from the sweep generator is approximately 20V amplitude and negative going from about 0V. This is applied via RV16 (X gain) to the input of a see-saw amplifier with a gain of about 10 which provides the deflection sawtooth to the X plates which are at a mean potential of +200V.

RV17 provides X SHIFT into the grid of V28b while R18 (X astig) allows V29b to be balanced against V28b to minimise X astigmatism.

The screen leads to the X plates form the feedback capacitances.

An external sweep waveform may be fed into the X amplifier by removing the link to earth from R188 (sweep in terminal) and applying the waveform to R188 (sweep in terminal).

7.9.6. Y Amplifier Output Stage

The output Y amplifier is formed by the long-tailed pair V19a and V20a which receive push-pull signals, with shift, at a d.c. level of about +110V from the cathode followers of the plug-in amplifier. The amplifier has a gain of about 10 and the d.c. level to the Y plates of the tube is +200V set by RV19 (Y astig).

7.9.7. Tube Flood Gun Circuits

The READ or STORE condition is selected by SW5.

For the STORE condition, the backing electrode (cap 5) is connected to +325V and the flood gun cathode (pin 33) is elevated to +200V thus cutting off the flood beam.

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

In the READ condition the flood gun cathode is returned to +100V with the backing electrode connected to the cathode of V21a via the **erase** amplitude control.

The potential of the backing electrode relative to the flood gun cathode is set by the BACKGROUND control supplying the grid voltage to the cathode follower V21a. Persistence pulses are also applied to the grid of this valve through C45. A 50 cycle square-wave is generated by multivibrator V22 and is varied in amplitude by RV25 before differentiation by C45 and RV24. The latter varies the differentiating time constant and therefore the width of the pulse. The negative going pulses are clipped by D2 leaving the positive pulses to be applied to the grid of V21a.

The flood gun grid is controlled by RV22 over a range of 7 to 40 volts negative relative to the READ condition of the flood gun cathode.

Clearing and erasure of the storage mesh are affected by SWC. In the central position of this switch some current is drawn from the collimation control RV21 through R221 into the tail of V21a.

When the switch is pushed to CLEAR this current drain is removed causing the collimation electrode (cap 1) to go a few volts positive. This slightly increases the flooded area of the storage mesh and prevents the formation of a bright ring during erase. At the same time C42 which has been charged to 325V by R234 is connected to the backing electrode and discharges into the tail of V21a. The resulting waveform applied to the backing electrode is therefore a rapid increase by 225V and an exponential decay back to normal in about 10ms.

SWC should now be pushed to ERASE again causing the collimation electrode to go slightly positive. At the same time R235 is connected to the backing electrode allowing some current to flow in RV27 (erase amplitude control). This results in a small increase in potential of the backing electrode sufficient to effect the erase. SWC is then returned to its central position completing the clear and erase cycle.

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7. CIRCUIT DESCRIPTIONS (continued)

7.10. Plug-in Units

7.10.1. Trace Shifter Y Amplifier Type 741/1. Circuit Diagram E22743

The input attenuator comprises four compensated inverted L sections of constant impedance selected by SWB. The sections have attenuation ratios of 100, 10, 5 and 2 respectively. The attenuator input is controlled by SWA which gives a choice of calibration, zero or input terminal a.c. and d.c.

The attenuated signal is passed to the grid of cathode follower V7 through the protective network, C11, R10. In the cathode of V7, R13 changes the d.c. level of the signal by about 2V before it is applied to one grid of the long-tailed amplifying pair V1a, V2a. The other grid is supplied with shift voltage from RV2. The cathodes are separated by R20 and R26 to allow gain control with RV1 and the anodes are directly coupled to the output cathode followers V1b, V2b.

The signal in the cathode of V7 is also applied to the synchronised amplifier V3a, whose anode is d.c. coupled to the output cathode follower V3b. A control, RV3, in the d.c. coupling network is preset to ensure that the synchronising signal is conveyed to the trigger shaper, in the main unit, at the correct d.c. level.

Trace-shifting is provided by the three divide-by-two stages V4, V5 and V6. The initiating trigger is derived from the anode of V26a in the main unit. This valve recharges the timing capacitor at the end of the sweep, the sudden large current developing a negative-going pulse across R136 which is applied to V4 in the plug-in through C28. The three valves are negative with respect to earth having their cathodes connected to a stable rail at -100V. One cathode in each valve can be momentarily disconnected from the rail by SWD to provide a reset to zero. In this condition V4a, V5a and V6a are conducting so that the first negative pulse applied to D5 and D6 switches over V4, the second pulse switches V4 back again and the negative going edge at V4a anode switches over V5. This action continues on successive pulses until the eighth pulse switches all valves back to the starting condition. The output anode of each valve is also joined to a mixing network of resistances (e.g. R74, R61 and R46) which have their common point joined to the Y shift control in the signal amplifier. It is arranged that each stage produces twice the voltage of the previous stage at the mixing point. Hence, equal increments of voltage are produced for each step. The number of steps is selected by SWC which simply eliminates the stages one by one.

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TYPE 741

7. CIRCUIT DESCRIPTIONS (continued)

7.10.2. Beamswitch Y Amplifier Type 741/2. Circuit Diagram E22744

There are two input attenuators each consisting of four compensated inverted L sections of constant impedance, selected by SWC and SWD respectively. The sections have ratios of 100, 10, 5 and 2.

Each attenuator input is controlled by separate switches (SWA and SWB) giving a choice of calibration, zero or input terminal a.c. and d.c.

The attenuated signal of each channel is passed to a cathode follower (V2a or V2b) through the protective networks C11, R10 and C26, R51. The output of each cathode follower is applied to the input grid of its respective long-tailed pair of amplifiers (V3a, V4a or V5a, V6a). The other grid of each pair is supplied with shift voltage from RV2 or RV3. The cathodes are separated by R24, R25 and R61, R66 to allow gain control with RV1 or RV4. The anodes are directly coupled to output cathode followers V3b, V4b or V5b, V6b.

The signal in the cathode of V2a or V2b as selected by SWF is applied to the synchronised amplifier V1a. The amplified signal is passed to the trigger shaper in the main unit via the d.c. coupling network C14, R34, R33 and RV5, the latter ensuring that the signal is conveyed at the correct d.c. level.

The beam switching waveform is generated by multivibrator V8 and applied in opposite phases to the cathode followers V9a and V9b. This has the effect of changing the anode supply voltage to each long-tailed pair in the amplifiers and, since the corresponding output cathode-followers in each channel have their cathodes joined, only the signal in the channel having the higher anode source voltage will appear at the output. Trimming capacitors on the grid of each cathode follower are provided to equalise stray capacitances and thus minimise switching noise.

The switching waveform at the cathodes of V9a and V9b are differentiated by C33, R87 and C32, R86 and added by diodes D2 and D3. The resulting negative pulses corresponding to the transitions of the switching waveform are passed via the cathode follower V1b to the main unit where they are mixed with the sweep unblanking signal at the cathode of V30.

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7. CIRCUIT DESCRIPTIONS (continued)

Channel selection is by SWE which in its central position allows V8 to oscillate, thus switching the main signal amplifier between Channel 1 and Channel 2 to provide a dual display. The two remaining positions select either Channel 1 or Channel 2 by disabling the oscillator and making V8a or V8b continuously conducting.

V7 provides a low impedance source of +150V as the anode supply for V8 and V2.

7.10.3. Single Ended Y Amplifier Type 741/3. Circuit Diagram E22742

The input attenuator comprises four compensated inverted L sections of constant impedance selected by SWB. The sections have attenuation ratios of 100, 10, 5 and 2 respectively. The attenuator input is controlled by SWA which gives a choice of calibration, zero or input terminal a.c. and d.c.

The attenuated signal is passed to the grid of cathode follower V7 through the protective network, C11, R10. In the cathode of V7, R13 changes the d.c. level of the signal by about 2V before it is applied to one grid of the long-tailed amplifying pair V1a, V2a. The other grid is supplied with shift voltage from RV2. The cathodes are separated by R20 and R26 to allow gain control with RV1 and the anodes are directly coupled to the output cathode followers V1b, V2b.

The signal in the cathode of V7 is also applied to the synchronised amplifier V3a, whose anode is d.c. coupled to the output cathode follower V3b. A control, RV3, in the d.c. coupling network is preset to ensure that the synchronising signal is conveyed to the trigger shaper, in the main unit, at the correct d.c. level.

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8. MAINTENANCE

8.1. Replacement of Storage Tube

Remove the old tube as follows:

Take off the L.H. side cover, unscrew the four knurled screws securing the mask and graticule to the front panel, carefully remove the tube base socket, disconnect the three cavity-cap connectors and the wander plug of the E.H.T. lead. Ease the tube out from the mu-metal screens by applying hand pressure to its base.

Install the new tube as follows:

Line up the E.H.T. cap with the cut-out in the bottom L.H. corner of the tube aperture and gently push the tube home until its face is level with the front panel. Replace the tube base socket, the cavity-cap connectors according to colour identification and the E.H.T. wander plug. Screw on the graticule and mask.

Switch on as instructed in Section 5.6. Initial Adjustments - Main Unit.

Controls requiring adjustment because of differences in tube characteristics are as follows:-

(a) Flood (RV22)

Operate the CLEAR switch to obtain a bright screen and adjust RV22 so that the screen is just completely covered with fluorescence.

(b) Collimation (RV21)

Operate CLEAR/ERASE switch, turn up some background and adjust RV21 to obtain the most even brightness possible over the whole screen area. It will be observed that the extremes of this control produce a bright centre patch and bright outer ring respectively. Operate CLEAR/ERASE and adjust RV21 alternately until the best result is obtained.

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8. MAINTENANCE

(c) Erase Amplitude (RV27)

Make successive adjustments of this control and operate CLEAR/ERASE alternately, holding the switch in the ERASE position for three seconds, until the brightness level of the screen is finally the same after every operation of the CLEAR/ERASE switch. It is necessary to have the background control in the centre of its travel for this adjustment.

(d) Preset Cut-off (RV4)

With a sweep rate of 5 sec/cm in the READ condition with some background just visible, adjust RV4 so that the traced line is storing adequately. (BEAM CUT OFF, RV15, should be one division from fully clockwise and BRIGHT UP LEVEL, RV14, fully anti-clockwise).

(e) Persistence Pulses

Generally it should only be necessary to adjust P.P. Amp. (RV25) such that some time after clear and erase the background is just increasing in brightness rather than decreasing.

(f) Alignment

With a straight line trace on the tube, slacken off the straps securing the mu-metal screens and rotate the complete tube assembly to align the trace with the graticule. Re-tighten the straps. Ensure that the cavity caps do not come into contact with the mu-metal screen.

(g) Focus (RV20)

This controls the sharpness of the trace and focusing may be carried out when using the instrument as a normal oscilloscope with a repetitive signal of low brightness. Variations of focus may occur with variations of time-base range and between READ and STORE conditions, especially on faster ranges.

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8. MAINTENANCE (continued)

(h) X Gain (RV16)

With the instrument in STORE condition, put on calibration waveform and adjust RV16 on 10ms TIME/cm range. Set four cycles to occupy 8 cm deflection.

(j) Y Gain

Adjust the gain control in each plug-in unit using the calibration waveform with VOLTS/cm at 0.1. Set for 6 cm deflection.

8.2. Voltage Table

All voltages except 7kV to be measured with 20,000 Ω/V meter, such as Avo 8.

Description	Location	Relative to	Condition	Reading
E.H.T. Osc. Screen	V14 Pin 9	Chassis	(Tube screen dark (Tube screen full brightness	-2V +56V
Raw H.T.	V1/V2 Pin 8	Mains Transformer Tmnl 12 (i.e -200V rail).	Normal mains voltage	+675V 705
-350	V3, pins 2, 4, 7.	-200V rail		-150V -150
85V Neon.	V4 pins 2, 4, 7.	-200V rail		-85V -85
-100	V12, pins 1, 5.	Chassis		-92V -98
-200	Mains Transformer Tmnl 12	Chassis		Set to -200V
+325	Junction R41, R37	Chassis		Set to +325V

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8. MAINTENANCE (continued)

Description	Location	Relative to	Condition	Reading
-800	Junction C30, R87	Chassis		-800V
-1600 Source	Junction R88, RV4	Chassis		-1700V
Shunt Stab. Ampr.	V10 pin 1	-200V rail		+150V
Shunt Stab. Ampr.	V10 pin 6	-200V rail		+140V
Series Stab. Grid.	V5 pin 5	V6-V9 pin 3		-10V
Raw Heater d.c.	Across C100			65V
Stab. Heater d.c.	Across C102			Set to 44V
Zener	Across Z1			22V
Raw negative d.c.	Across C5			360V
Anode	V28b pin 6	Chassis	Lock-out	+250V
Anode	V29b pin 6	Chassis	Lock-out	+163V
Screen	V28b pin 3	Chassis	Lock-out	+200V
Screen	V29b pin 3	Chassis	Lock-out	+200V
Anode	V19a pin 6	Chassis	No signal	+200V

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8. MAINTENANCE (continued)

Description	Location	Relative to	Condition	Reading
Anode	V20a pin 6	Chassis	No signal	+200V
Screen	V19a pin 3	Chassis	No signal	+305V
Screen	V20a pin 3	Chassis	No signal	+305V
+100V	V19b pin 8	Chassis		+110V
Backing electrode source.	V21a pin 8	Chassis		+112V
Cathode	V22, pins 3, 8.	+100		+8V
+200	V21b pin 7	Chassis		Set to +200V
Anode	V23a pin 6	Chassis	Depending on trigger selector switch and trigger level control	+200V to +325V
"	V24a pin 6	"		
Screen	V23a/V24a pin 3.	"		
Cathode	V23b/V24b pin 8.	Chassis		+155V
Anode	V25 pin 1	Chassis	Lock-out	+148V
Anode	V25 pin 6	Chassis	Lock-out	+190V
Cathode	V26a pin 3	Chassis	Lock-out	-1.5V
Cathode	V26b pin 8	-200	(Mult x 1 (Mult x 5	+108V + 14V
Cathode	V27b pin 8	Chassis	Lock-out	+150V

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8. MAINTENANCE (continued)

Description	Location	Relative to	Condition	Reading
Anode	V28a pin 1	Chassis	Lock-out	+12V
			Prime (before sweep)	-26V
			Prime (after sweep)	+12V
			Normal (no sweep)	-26V
Cathode	V30 pin 3	Chassis	Bright up level fully anticlockwise	+155V
			Bright up level fully clockwise	+202V
Cathode	V30 pin 8	Chassis	Bright up level fully anticlockwise	+156V
			Bright up level fully clockwise	+175V

Tube Base and Cap Voltages (with respect to Chassis)

Base Pin No.	Electrode	Control setting	Reading
6	Focus	Focus fully anticlockwise	-472V
		Focus fully clockwise	-520V
10	Writing Grid	Preset Cut-off (RV4)	Set to -850V (see notes)
27	Writing Cathode		-810V
15	First Anode		+110V
32	Flood Grid	Flood (RV22) fully anticlockwise.	+104V
		" fully clockwise	+ 62V

REMSCOPE

TYPE 741

8. MAINTENANCE (continued)

Base Pin No.	Electrode	Control setting	Reading
33	Flood Cathode	Read	+110V
		Store	+200V
17	Flood G2		+200V
Cap No.			
1 (Grey)	Collimating	Collm.(RV21) fully anticlockwise.	+150V
		" fully clockwise.	+180V
2 (Blue)	Flood G4		+325V
5 (Red)	Backing	Read (Bkgnd fully anticlockwise	+117V
		(Bkgnd fully clockwise	+130V
		Store	+325V
Screen			+7kV

Notes

The deflection electrodes on base pins 3, 4, 13 and 14 will have potentials centred around +200V.
Base pins 8 and 9 have 6.3V a.c. between them at a d.c. potential of -800V with respect to chassis.
Base pins 22 and 35 have 6.3V a.c. between them at a d.c. potential of +100Vwith respect to chassis.
It is recommended that the writing grid potential is no more positive than this when installing a tube. It is subsequently set as described in Section 8.1. Replacement of Storage Tube.

REMSCOPE

TYPE 741

9. SPECIFICATION

9.1. MAIN UNIT

General

Dimensions:	22½ x 17½ x 11½ in. (57cm x 44cm x 29cm) approx.
Weight:	67lb (30kg) approx. with average plug-in unit.
Finish:	Two tone green.
Power Consumption:	250W with average plug-in unit.

Storage Tube

Type:	English Electric E702A. Non Linearity X 1% " " Y 3%.
Screen Diameter:	10cm.
Fluorescence:	Yellow.
Resolution:	20 lines/cm
Writing Speed:	1μs/cm approx.
E.H.T:	7.0kV.

Storage and Display

Display Time:	10 minutes (continuous viewing of stored trace).
Storage Time:	1 week. Trace available for viewing.
Erase Time:	4 seconds approx.

Time Base Generator

Time Measurement:	1μs/cm - 5sec/cm in decade steps using the X5 continuously variable multiplier.
Sawtooth Amplitude:	20V negative going.

REMSCOPE

TYPE 741

9. SPECIFICATION (continued)

Non-Linearity:	1%
Gate Output:	15V negative going; available externally.

Triggering

Facilities:	a.c. or d.c. coupled, internally or externally. Positive or negative polarity. Triggered or free running. Variable level. Single Shot.
Sensitivity:	External 0.5 - 50V Internal 0.5cm deflection.
Delay:	0.5µs.

Calibrator

Amplitude:	0.6V ±2%.
Frequency:	Mains.

9.2. PLUG-IN UNITS

9.2.1. Trace Shifter Y Amplifier Type 741/1

Sensitivity:	100mV/cm to 50V/cm in 1, 2, 5 steps.
Rise Time:	0.2µs. Bandwidth 1.5Mc/s.
Max. Voltage Input:	500V
Input Resistance:	1MΩ.
Input Capacitance:	50pF.
Input Time Constant (when a.c. coupled):	0.1 sec.
No. of Steps:	2, 4 or 8 traces.

REMSCOPE

TYPE 741

9. SPECIFICATION (continued)

Step Initiation:	Automatically initiated by trailing edge of sweep gate.
Step Amplitude:	Automatically adjusted for suitable trace spacing.
Manual Reset:	Trace may be reset to starting position.

9.2.2. Beamswitch Amplifier Type 741/2

All facilities for two channels as for single channel in Type 741/3. but without trace shifter.

Operation:	Channel 1 individually " 2 " " 1 and 2 switching during trace at 250kc/s.

9.2.3. Single Ended Y Amplifier Type 741/3

All facilities as in Type 741/1 but without trace shifter.

9.3. PROBE TYPE 741/6

Attenuation Ratio:	10:1
Input Resistance:	10MΩ
Input Capacitance:	17μμF approx.
Maximum Input:	400V.

REMSCOPE

TYPE 741

10. GUARANTEE

Our products are carefully inspected and submitted to comprehensive tests at our factory before despatch. We therefore give to all purchasers (subject to the terms of payment and all the customer's other obligations being strictly observed) the following guarantee, which excludes and takes the place of any condition or warranty implied by Statute or otherwise.

If within three years from the date of despatch, any defect is discovered in the instrument in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense, provided notice is given to us as soon as it is discovered, and that the apparatus is immediately forwarded to our factory, carriage paid and with seals unbroken. Our responsibility is in all cases limited to the cost of making good the defect in the apparatus itself. This guarantee is given to our customers and does not extend to third parties, nor does it apply to defects caused by wear and tear, abnormal conditions of working, accident, misuse or neglect.

In the case of material and components not of our manufacture, we give the customer the benefit of any guarantee given to us by the manufacturer of such parts. In the case of the storage tube this is:

(a) Validity 1 year from date of purchase or 1000 hours operation, whichever period is the shorter.

(b) Free replacement for tubes failing within 50 hours operation due to mechanical defects.

(c) Tubes failing within the period of 50 to 1000 hours will be replaced or credit given on a pro rata basis determined by the unrealised portion of the warranted life to the total warranty period (1000 hours operation).

11. SERVICING PROCEDURE

The information given in this booklet should enable the user to maintain the equipment in proper working order. If difficulties arise, please write or telephone our Service Department or our Representative or Agent for your area or country. In certain cases we may be able to arrange for an outside service engineer to call on you.

When contacting our Service Department please mention the serial and type numbers of your instrument and include a full report of the fault encountered, as well as details of the action taken to eliminate it.

REMSCOPE

TYPE 741

11. SERVICING PROCEDURE (continued)

This information should be addressed to:-

Service Department,
Dawe Instruments Limited,
Western Avenue,
Acton,
London, W.3.

Tel: ACOrn 6751.

If the equipment is returned for service, please include a copy of any relevant correspondence, together with all the accessories and the Instruction Book.

This procedure will facilitate the work of our Service Department and expedite the return of the instrument.

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12. COMPONENTS LIST

12.1. Main Unit.

Ref.	Value	Tol	Rating	Manufacturer	Location
R1	22	5%	10w	Welwyn AW3192	Main Chassis Assy.
R2	22	"	"	" AW3192	" " "
R3	150	"	6w	" AW3112	Rect Unit.
R4	150	"	"	" AW3112	" "
R5	150	"	"	" AW3112	" "
R6	150	"	"	" AW3112	" "
R7	220	10%	1/2w	Dub Type BTA	" "
R8	6.8k	5%	2w	Elect. CJ42	" "
R9	6.8k	5%	"	" CJ42	" "
R10	150k	10%	1/2w	Dub Type BTA	" "
R11	150k	"	"	" "	" "
R12	100k	"	"	" "	Stab Unit
R13	33k	"	"	" "	" "
R14	47	"	1/4w	" BTT	" "
R15	47	"	"	" "	" "
R16	100	"	"	" "	" "
R17	100k	"	1/2w	" BTA	" "
R18	3.3k	"	1/4w	" BTT	" "
R19	33k	"	"	" "	" "
R20	820k	5%	1/2w	Stc. 4304	" "
R21	1M	"	"	" "	" "
R22	270k	"	1/4w	" 4305	" "
R23	8.2k	10%	1/2w	Dub. Type BTA	" "
R24	36k	5%	1/4w	Stc. 4305	" "
R25	390k	"	"	" "	" "
R26	47	10%	"	Dub. Type BTT	" "
R27	100	"	"	" "	" "
R28	47	"	"	" "	" "
R29	33	"	"	" "	" "
R30	47	"	"	" "	" "
R31	100	"	"	" "	" "
R32	47	"	"	" "	" "
R33	33	"	"	" "	" "
R34	47	"	"	" "	" "
R35	100	"	"	" "	" "
R36	47	"	"	" "	" "
R37	33	"	"	" "	" "
R38	47	"	"	" "	" "
R39	100	"	"	" "	" "
R40	47	"	"	" "	" "
R41	33	"	"	" "	" "
R42	68k	5%	2w	Elect. CJ42	" "
R43	68k	"	"	" "	" "
R44	6.8k	10%	1/2w	Dub. Type BTA	" "
R45	1M	5%	"	Stc. 4304	" "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
R46	47	10%	1/4w	Dub. Type BTT	Stab. Unit
R47	100	"	"	" "	" "
R48	47	"	"	" "	" "
R49	100	"	"	" "	" "
R50	300k	"	"	" "	" "
R51	330k	"	"	" "	" "
R52	470k	"	"	" "	" "
R53	330k	"	"	" "	" "
R54	47	"	"	" "	" "
R55	100	"	"	" "	" "
R56	47	"	"	" "	" "
R57	10k	"	1/2w	" BTA	" "
R58	Not Used				
R59	Not Used				
R60	2.7M	2%	1/2w	Stc. 4304	" "
R61	2.7M	"	"	" "	" "
R62	2.2M	"	"	" "	" "
R63	2.2M	"	"	" "	" "
R64	1.8M	"	"	" "	" "
R65	100k	5%	2w	Elect. CJ42	" "
R66	47	10%	1/4w	Dub. Type BTT	" "
R67	100	"	"	" "	" "
R68	47	"	"	" "	" "
R69	100	"	"	" "	" "
R70	1M	"	"	" "	" "
R71	33k	5%	6w	Welwyn AW3112	" "
R72	680k	10%	1/4w	Dub. Type BTT	" "
R73	150k	"	"	" "	" "
R74	47	"	1/2w	" BTA	" "
R75	470	5%	2w	Elect. CJ42	" "
R76	47	10%	1/4w	Dub. Type BTT	" "
R77	47	"	"	" "	" "
R78	100	"	"	" "	" "
R79	Not used				
R80	220k	10%	1/4w	Dub. Type BTT	" "
R81	2.2k	"	"	" "	" "
R82	47	"	1/2w	Dub. Type BTA	" "
R83	150	"	"	" "	" "
R84	150	"	"	" "	" "
R85	1M	"	"	" "	" "
R86	100M	20%		Dub. MVX style 8	" "
R87	47k	10%	1/4w	Dub. Type BTT	" "
R88	47k	"	"	" "	" "
R89	Not used				
R90	100k	1%	1/2w	Stc. 4304	Rect. Unit
R91	300	"	"	" "	" "
R92	330k	10%	"	Dub. BTA	" "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
R263	150			Dub. BTA	EHT Unit
R264	150			" "	" "
R270	22k			" BTA	Y Amp Stab. Unit
R271	470			" BTT	" " "
R272	6.8k			" BTT	" " "
R273	33k			" BTA	" " "
R274	33k			Stc. 4305	" " "
R275	27k			" "	" " "
R276	6.8k			" "	" " "
R277	22k	5%	6w	Welwyn A33112	
C1	60µ		450v	TCC CE202P	Rect. Unit
C2	60µ		"	" "	" "
C3	60µ		"	" "	" "
C4	60µ		"	" "	" "
C5	32µ		"	" CE199PC	" "
C6	32µ		"	" "	" "
C7	0.1µ		500v	Dub 660 17903	Stab. Unit
C8	0.1µ		"	" "	" "
C9	0.1µ		350v	" 700	" "
C10	0.1µ		"	" "	" "
C11	0.1µ		"	" "	" "
C12	0.1µ		"	" "	" "
C13	0.1µ		"	" "	" "
C14	0.1µ		"	" "	" "
C15	0.1µ		"	" "	" "
C16	0.1µ		"	" "	" "
C17	0.25µ		250v	Dub 700 A225	EHT Unit
C18	0.01µ		400v	Dub 700 A231	" "
R93	1M	10%	1/4w	Dub BTT	Front P. Term.Unit
R94	100k	5%	3/4w	Stc. 4304	Trigger Shaper
R95	47k	5%	1/4w	Stc. 4305	" "
R96	47k	5%	1/4w	Stc. 4305	" "
R97	100k	5%	1/4w	Stc. 4305	" "
R98	100k	5%	1/4w	Stc. 4305	" "
R99	56k	5%	1/4w	Stc. 4305	" "
R100	10k	10%	1/2w	Dub. BTA	" "
R101	47	10%	1/4w	Dub. BTT	" "
R102	100	10%	1/4w	Dub. BTT	" "
R103	47	10%	1/4w	Dub. BTT	" "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer		Location
R104	33k	10%	1/2w	Dub.	BTA	Trigger Shaper
R105	3.3k	10%	1/2w	"	"	" "
R106	47	10%	1/4w	"	BTT	" "
R107	100	10%	1/4w	"	BTT	" "
R108	47	10%	1/4w	"	BTT	" "
R109	18k	5%	6w	Welwyn	AW3112	" "
R110	110k	5%	1/2w	Stc.	4304	" "
R111	330k	5%	1/2w	Stc.	4304	" "
R112	47k	10%	1/4w	Dub.	BTT	" "
R113	2.2k	10%	1/4w	"	BTT	" "
R114	47	10%	1/4w	"	BTT	" "
R115	100	10%	1/4w	"	BTT	" "
R116	18k	5%	2w	Elect	CJ42	" "
R117	560	10%	1/4w	Dub.	BTT	" "
R118	47	10%	1/4w	Dub.	BTT	" "
R119	100	10%	1/4w	Dub.	BTT	" "
R120	2.2M	"	"	"	"	" "
R121	150k	5%	1/2w	Stc.	4304	" "
R122	330k	"	"	"	"	" "
R123	10k	10%	1/4w	Dub.	BTT	Scan Gen.
R124	150k	"	"	"	"	" "
R125	1M	5%	1/2w	Stc.	4304	" "
R126	1.5M	"	3/4w	"	4303	" "
R127	6.8k	10%	1/2w	Dub.	BTA	" "
R128	47	"	1/4w	"	BTT	" "
R129	100	"	"	"	"	" "
R130	2.2k	"	"	"	"	" "
R131	6.8k	"	1/2w	"	BTA	" "
R132	47	"	1/4w	"	BTT	" "
R133	100	"	"	"	"	" "
R134	27k	5%	3w	Welwyn	AW3112	" "
R135	2.2M	10%	1/4w	Dub.	BTT	" "
R136	6.8k	"	"	"	"	" "
R137	470k	5%	1/2w	Stc.	4304	" "
R138	820k	"	"	"	"	" "
R139	47	10%	1/4w	Dub.	BTT	" "
R140	100	10%	"	"	"	" "
R141	10k	"	"	"	"	" "
R142	1M	"	1/2w	"	BTA	" "
R143	680k	"	"	"	"	" "
R144	9.1k	2%	"	Stc.	4304	Front P. Term. Unit.
R145	100k	"	"	"	"	" " "
R146	47	10%	1/4w	Dub.	BTT	Scan Gen.
R147	100	"	"	"	"	" "
R148	200k	5%	1/2w	Stc.	4304	" "
R149	150k	"	"	"	"	" "
R150	"	"	"	"	"	" "
R151	47	10%	1/4w	Dub.	BTT	" "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer		Location
R152	100	10%	1/4w	Dub.	BTT	Scan Gen.
R153	47k	5%	2w	Elect.	CJ42	" "
R154	"	10%	1/4w	Dub.	BTT	" "
R155	Not Used					
R156	100	10%	1/4w	Dub.	BTT	" "
R157	33k	5%	2w	Elect.	CJ42	" "
R158	22k	10%	1/4w	Dub.	BTT	Tube Cct. A
R159	330k	10%	1/2w	"	BTA	" " "
R160	220k	"	"	"	"	" " "
R161	150k	5%	2w	Elect.	CJ42	" " "
R162	6.8k	10%	1/4w	Dub.	BTT	" " "
R163	47	"	1/2w	"	BTA	" " "
R164	47	"	1/4w	"	BTT	" " "
R165	100	"	"	"	"	" " "
R166	15k	5%	2w	Elect.	CJ42	" " "
R167	47	10%	1/4w	Dub.	BTT	" " "
R168	100	"	"	"	"	" " "
R169	10k	"	1/2w	"	BTA	" " "
R170	10k	"	1/4w	"	BTT	" " "
R171	2.2M	"	"	"	"	" " "
R172	56k	"	1/2w	"	BTA	" " "
R173	10k	"	1/4w	"	BTT	" " "
R174	15k	"	"	"	"	Front P. Term. Unit.
R175	10k	"	"	"	"	" " " "
R176	33k	"	1/2w	"	BTA	" " " "
R177	120k	"	"	"	"	" " " "
R178	100k	"	1/4w	"	BTT	Tube Cct. A
R179	47	"	"	"	"	" " "
R180	100	"	"	"	"	" " "
R181	47k	5%	2w	Elect.	CJ42	" " "
R182	68k	10%	1/2w	Dub.	BTA	" " "
R183	47	"	1/4w	"	BTT	" " "
R184	100	"	"	"	"	" " "
R185	100k	5%	2w	Elect.	CJ42	Front P. Term Unit.
R186	100k	2%	1/2w	Stc.	4304	Tube Cct. A
R187	15k	10%	1/4w	Dub.	BTT	" " "
R188	100k	2%	1/2w	Stc.	4304	" " "
R189	680k	2%	"	"	"	" " "
R190	220k	"	"	"	"	" " "
R191	47:	10%	1/4w	Dub.	BTT	" " "
R192	100	"	"	"	"	" " "
R193	47k	"	1/2w	"	BTA	Front P. Term Unit.
R194	47	"	1/4w	"	BTT	Tube Cct. A
R195	22k	5%	2w	Elect.	CJ42	" " "
R196	33k	"	"	"	"	" " "
R197	22k	"	"	"	"	" " "
R198	47	10%	1/4w	Dub.	BTT	" " "
R199	47	"	"	"	"	" " "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
R200	100	10%	1/4w	Dub. BTT	Tube Cct. A
R201	1M	2%	1/2w	Stc. 4304	" " "
R202	390k	10%	"	Dub. BTA	" " "
R203	820k	2%	"	Stc. 4304	" " "
R204	56k	10%	"	Dub. BTA	Front P. Term Unit.
R205	10k	"	"	" "	Trigger Shaper
R206	12k	5%	6w	Welwyn AW3112	Tube Cct. A
R207	15k	"	"	" "	" " "
R208	47	10%	1/4w	Dub. BTT	" " "
R209	100	"	"	" "	" " "
R210	47	"	"	" "	" " "
R211	4.7k	5%	2w	Elect. CJ42	" " "
R212	15k	"	6w	Welwyn AW3112	" " "
R213	47	10%	1/4w	Dub. BTT	" " "
R214	"	"	"	" "	" " "
R215	100	"	"	" "	" " "
R216	Not Used				
R217	680	10%	1/2w	" BTA	" " "
R218	"	"	"	" "	" " "
R219	22k	"	1/4w	" BTT	Tube Cct. B
R220	68k	"	"	" "	" " "
R221	220k	"	"	" "	" " "
R222	1.2M	"	1/2w	" BTA	Front P. Term Unit.
R223	680k	"	1/4w	" BTT	Tube Cct. B.
R224	470k	5%	1/2w	Stc. 4304	" " "
R225	"	"	"	" "	" " "
R226	680k	"	"	" "	" " "
R227	"	"	"	" "	" " "
R228	"	"	"	" "	" " "
R229	"	"	"	" "	" " "
R230	100k	10%	1/4w	Dub. BTT	Front P. Term Unit.
R231	470k	"	"	" "	" " " "
R232	560	"	"	" "	" " " "
R233	8.2k	"	1/2w	" BTA	Tube Cct. B
R234	1M	"	1/4w	" BTT	Front P. Term Unit.
R235	100k	"	1/2w	" BTA	" " " "
R236	220k	"	"	" "	Tube Cct. A
R237	47	"	1/4w	" BTT	" " "
R238	100	"	"	" "	" " "
R239	100k	"	"	" "	" " "
R240	100k	"	1/2w	" BTA	Front P. Term Unit.
R241	47	"	1/4w	" BTT	Tube Cct. A
R242	100	"	"	" "	" " "
R243	68k	5%	2w	Elect. CJ42	" " "
R244	220k	10%	1/4w	Dub. BTT	" " "
R245	100k	"	"	" "	" " "
R246	47	"	"	" "	" " "
R247	100	"	"	" "	" " "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
R248	4.7k	10%	1/4w	Dub. BTT	Tube Cct. A
R249	47	"	"	" "	" " "
R250	100	"	"	" "	" " "
R251	15k	5%	2w	Elect. CJ42	" " "
R252	390k	"	1/2w	Stc. 4304	" " "
R253	100k	10%	"	Dub. BTA	" " "
R254	47	"	1/4w	" BTT	" " "
R255	100	"	"	" "	" " "
R256	470k	5%	1/2w	Stc. 4304	" " "
R257	47	10%	1/4w	Dub. BTT	" " "
R258	47	"	"	" "	" " "
R259	100	"	"	" "	" " "
R260	2.7k	"	1/2w	" BTA	Trigger Shaper
R261	1M	"	1/4w	" BTT	Front P. Term Unit.
R262	1M	"	"	" "	" " " "
R265	22k	"	1/2w	" BTA	" " " "
C34	4-60p	-	-	Mullard E7891	Tube Cct. A
C35	220p	10%	-	Lemco 1510E	" " "
C36	0.1µ		500v	Dub. T660	Tube Cct. B
C37	4-60p	-	-	Mullard E7891	" " "
C39	150p	10%	-	Lemco 2010	" " "
C40	"	"	-	" "	" " "
C41	"	"	-	" "	" " "
C42	.25µ		350v	Dub. T700	Front P. Term Unit.
C43	0.1µ		"	" "	Tube Cct. A
C44	.01µ		"	" "	" " "
C45	.01µ		"	" "	" " "
C46	100p	10%	-	Lemco 1510	" " "
C47	.05µ		350v	Dub. T700	" " "
C48	64µ		350v	TCC CE 97 KC	" " "
C49	.1µ		350v	Dub. T700	" " "
C50	.1µ		"	" "	" " "
C51	.1µ		"	" "	" " "
C52	.1µ		500v	" 17903 T660	Front P. Term Unit.
C53	.01µ		400v	" T700	Trigger Shaper
C54	.1µ		350v	" "	" "
C55	.1µ		150v	" "	" "
C56	5000p	10%		Lemco 2515	" "
C57	10p	"		" 1106R	" "
C58	220p	"		" 1510E	Scan. Gen.
C59A	.5µ		250v	Dub. T700	Time/Cm Sw Assy.
C59B	.5µ		"	" "	" " "
C60	.25µ		350v	" "	" " "
C61	.047µ	10%	400v	Wima Torpyfol 'M'	" " "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
C62	047uf		400v	Wima Tropyfol 'M'	EHT Unit
C63	5000p	10%		Lemco 2515	Time/Cm. Sw. Assy.
C64	470p	"		" 1510E	" " "
C65	68p	"		" 1106R	Scan Gen.
C66	0.5µ		250v	Dub. T700	" "
C67	3-30p			Mullard E7890	Time/Cm. Sw. Assy.
C68	100p		20v	Union Cabide K100J20.	" " "
C69	22µ		35v	Union Cabide K22J35.	" " "
C70	1µ	2%	125v	Wima Troyfol 'M'	" " "
C71	1µ	"	"	" " "	" " "
C72	.22µ	"	"	" " "	" " "
C73	.022µ	"	"	" " "	" " "
C74	2000p	"	"	Lemco 2010 "	" " "
C75	180p	10%		" 1510	" " "
C76	15p	"		" 1106R	Scan. Gen.
C77	.1µ		350v	Dub. T700	" "
C78	100p	10%		Lemco 1510	Tube Cct. A
C79					
C80	.002µ	10%			
C81	.01µ		400v	Dub. T700	" " "
C82	0.1µ		350v	" "	" " "
C83	3-30p			Mullard E7890	" " "
C84	3-30p			" "	" " "
C85	0.1µ		350v	Dub. T700	" " "
C86	3-30p			Mullard E7890	" " "
C87	0.1µ		350v	Dub. T700	" " "
C88	82p	10%		Lemco 1510	" " "
C89	.25µ		350v	Dub. T700	Trigger Shaper
C90	300p	10%		Lemco 1510E	Front P. Term Unit.
C91	82p	"		" 1510	Tube Cct. A
C92	0.1µ		350v	Dub. T700	Front P. Term Unit.
C93	.01µ		400	Dub. T700	Tube Cct. A
RV5	1M			Mor. T.U.3/4 Shaft.	F.P. Component Assy,
RV6	1M			Mor. T.U.3/4 Shaft.	" "
RV7	100k			Mor. T.L.P.H.	Scan. Gen.
RV8	100k			Colvern CLR4201/15	F.P. Component Assy
RV9	200k			Mor. T.L.P.H.	Scan. Gen.
RV10	50k			" " "	" "
RV11	50k			" " "	" "
RV12	100k			" " "	Tube Cct. A
RV13	2k			" " "	" "
RV14	50k			Mor. T.U.3/4 Shaft.	F.P. Component Assy.

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
RV15	10k			Mor T.U.3/4 Shaft	F.P. Component Assy.
RV16	5k			Mor Type L.P.H.	Tube Cct. A
RV17	50k			Mor T.U.3/4 Shaft	F.P. Component Assy.
RV18	100k			Mor Type L.P.H.	Tube Cct. A
RV19	2k			Colvern T. PC1/2/P	" " "
RV20	100k			Mor T.U.3/4 Shaft	F.P. Component Assy.
RV21	50k			Mor T. L.P.H.	Tube Cct. B
RV22	5k			" "	" " "
RV23	10k			Mor T.U.3/4 Shaft	F.P. Component Assy.
RV24	20k			Mor T. L.P.H.	Tube Cct. A
RV25	2k			" "	" " "
RV26	100k			" "	" " "
RV27	5k			" "	" " "
RV28	100k	Set B.U.		" "	F.P. Term Board
D.2				Mullard OA81	Tube Cct. A
D.5				" "	Scan. Gen.
D.6				" OA202	" "
D.7				" "	" "
D.8				" OA81	Tube Cct. A
D.9				" "	" " "
D.10				" "	" " "
D.11				" "	" " "
D.12				" "	" " "
V.19				Mullard ECF 80	Tube Cct. A
V.20				" " "	" " "
V.21				" " 82	" " "
V.22				" " 81	" " "
V.23				" " 82	Trigger Shaper
V.24				" " "	" "
V.25				" ECC 81	Scan. Gen.
V.26				ECC 83	" "
V.27				" " 81	" "
V.28				" ECF 82	Tube Cct. A
V.29				" " 82	" " "
V.30				" ECC 81	" " "
V.31				E.E.V. E702A	Tube Assy.
SWB		Read/Store		D/PD/Throw NSF	F.P. Component Assy.
SWC		Clear/Erase		Bulgin S702	" " "
SWD		Normal/Prime		" S701	" " "
SWE		Time/Cm		NSF.No.22700	" " "
SWF		Int/Ext.		" 22701	" " "
SWG		Free/AC/DC		Bulgin S700	" " "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
Term 1		Earth		Belling Lee L1499/15L	F.P. Component Assy.
Term 2		Ext. Sweep		" " "	" " "
Term 3		Sweep Out		" " "	" " "
SK1				McMurdo R.S. 16	Main Harness
SK2				Trans R. UHF83 LDO 71A	F.P. Component Assy.
SK3				Belling Lee L1317	Tube Cct. B
SK4				Spear Eng No.S161	Front P. Comp. Assy.
C19	1µ		350v	Dub 412 A28	E.H.T. Unit
C20	0.5µ		350v	" 700	" "
C21	0.01µ		400v	" 700 A231	" "
C22	.002µ		8kv	" 500HT 15637	" "
C23	0.1µ		350v	" 700	" "
C24	.002µ	10%		Lemco 2515	" "
C25	.001µ	10%		" 2010	" "
C26	1µ		350v	Dub. 412 A28	" "
C27	.001µ		15kv	Dub 500HT 15212	" "
C28	.001µ		"	" " "	" "
C29	.05µ		2kv	" " 15974	" "
C30	.05µ		"	" " "	" "
C31	.05µ		"	" " "	" "
C32	.05µ		"	" " "	" "
C33	.001µ	10%		Lemco 2010	Rect. Unit.
C100	250µ		100v	T.C.C. CE26 EC	Y. Amp. Stab. Unit
C101	.1µ		150v	Dub. A214	" " " "
C102	50µ		50v	T.C.C. CE112D	" " " "
C103	.1µ		150v	Dub. A214	" " " "
RV1	10k			Morganite L.P.H.	Stab. Unit.
RV2	10k			" "	" "
RV3	10k			" "	" "
RV4	500k			" CU	E.H.T. Unit
RV30	10k			" L.P.H.	Y. Amp. Stab. Unit
RV31	2k			" "	" " " "

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
D1			Int. Rect. SD910		Rect. Unit.
D3			Mullard OA202		" "
D4			"	"	" "
D13			Int. Rect. SD94		Y. Amp. Stab. Unit
D14			"	"	" " " "
D15			"	"	" " " "
D16			"	"	" " " "
T1			Trans Equip CAEM 158E		Trans. Assy.
T2			Trans Equip CAEM 159Y		" "
V1			Mullard GZ34		Rect. Unit
V2			"	"	" "
V3			"	150CZ	" "
V4			"	85A2	Stab. Unit.
V5			"	EF91	" "
V6			"	EL86	" "
V7			"	EL86	" "
V8			"	"	" "
V9			"	"	" "
V10			"	ECC81	" "
V11			"	EL86	" "
V12			"	108C1	" "
V13			"	ECC82	E.H.T. Unit.
V14			"	EL84	" "
V15			"	EY51	" "
V16			"	"	" "
V17			"	"	" "
V18			"	"	" "
SWA			N.S.F. No. 8370B3		Front P. Comp. Assy.
PL1	Mains in		Bulgin SA1403		Mains Input Panel
PL3	EHT Plug		Belling Lee L3783		E.H.T. Unit.

12. COMPONENTS LIST

12.1. Main Unit (Cont'd).

Ref.	Value	Tol.	Rating	Manufacturer	Location
F1		3A	1. 1/4" Long.		
F2		500mA	1. 1/4" Long.		
LP1	Indicating Lamp		Bulgin D799		Front Panel Comp Assy
TR1			Mullard OC36		Y. Amp. Stab. Unit
TR2			G.E.C. GET114		" " " "
TR3			Mullard OC77		" " " "
Z1			MEZ22		" " " "

12.2. Trace Shifter Y Amplifier Type 741/1

Ref.	Value	Tol.	Rating	Manufacturer	Location
R1	900k	1%	1/2w	Stc. 4304	Y. Amp.
R2	110k	1%	1/2w	Stc. 4304	" "
R3	990k	"	"	" "	" "
R4	10.1k	"	"	" "	" "
R5	500k	"	"	" "	" "
R6	1M	"	"	" "	" "
R7	800k	"	"	" "	" "
R8	250k	"	"	" "	" "
R9	1M	"	1/4w	" 4305	" "
R10	100k	"	"	" "	" "
R11	100	10%	"	Dub. BTT	" "
R12	47	"	"	" "	" "
R13	470	"	"	" "	" "
R14	39	5%	2w	Elect. CJ42	" "
R15	100	10%	1/4w	Dub. BTT	" "
R16	6.8k	5%	1/2w	Stc. 4304	" "
R17	47	10%	1/4w	Dub. BTT	" "
R18	47	"	"	" "	" "
R19	47	"	"	" "	" "
R20	330	10%	"	" "	" "
R21	8.2k	5%	5w	Welwyn AW3111	" "
R22	6.8k	"	"	" "	" "
R23	6.8k	"	1/2w	Stc. 4304	" "
R24	47	10%	1/4w	Dub. BTT	" "
R25	100	"	"	" "	" "

12. COMPONENTS LIST

12.2. Trace Shifter Y Amplifier Type 741/1 (cont'd)

Ref.	Value	Tol.	Rating	Manufacturer	Location
R26	330	10%	1/4w	Dub. BTT	Y. Amp.
R27	750k	5%	1/2w	Stc. 4304	" "
R28	1M	10%	1/4w	Dub. BTT	" "
R29	910	5%	1/2w	Stc. 4304	" "
R30	100	10%	1/4w	Dub. BTT	" "
R31	47	"	"	" "	" "
R32	47k	5%	2w	Elect. CJ42	" "
R33	100	10%	1/4w	Dub. BTT	" "
R34	47	"	"	" "	" "
R35	47k	5%	2w	Elect. CJ42	" "
R36	390k	10%	1/4w	Dub. BTT	" "
R37	330k	"	"	" "	" "
R38	15k	"	"	" "	" "
R39	15k	"	"	" "	" "
R40	47	"	"	" "	" "
R41	47	"	"	" "	" "
R42	100	"	"	" "	" "
R43	330	"	"	" "	" "
R44	47k	"	"	" "	" "
R45	39k	"	"	" "	" "
R46	75k	5%	"	Stc. 4305	Trace Shifter
R47	1M	10%	"	Dub. BTT	" "
R48	470k	10%	"	" BTT	" "
R49	220k	"	"	" "	" "
R50	100	"	"	" "	" "
R51	220k	"	"	" "	" "
R52	10k	"	"	" "	" "
R53	10k	"	"	" "	" "
R54	47	"	"	" "	" "
R55	22k	"	"	" "	" "
R56	47	"	"	" "	" "
R57	100	"	"	" "	" "
R58	220k	"	"	" "	" "
R59	220k	"	"	" "	" "
R60	100k	"	"	" "	" "
R61	150k	5%	"	Stc. 4305	" "
R62	75k	5%	"	" "	" "
R63	220k	10%	"	Dub. BTT	" "
R64	100	"	"	" "	" "
R65	220k	"	"	" "	" "
R66	10k	"	"	" "	" "
R67	"	"	"	" "	" "
R68	47	"	"	" "	" "
R69	22k	"	"	" "	" "
R70	47k	"	"	" "	" "
R71	220k	"	"	" "	" "

12. COMPONENTS LIST

12.2. Trace Shifter Y Amplifier Type 741/1 (cont'd)

Ref.	Value	Tol.	Rating	Manufacturer	Location
R72	220k	10%	1/4w	Dub. BTT	Trace Shifter
R73	100k	"	"	" "	" "
R74	300k	5%	"	Stc. 4305	" "
R75	150k	5%	"	" "	" "
R76	75k	"	"	" "	" "
R77	220k	10%	"	Dub. BTT	" "
R78	100.	"	"	" "	" "
R79	220k	"	"	" "	" "
R80	10k	"	"	" "	" "
R81	10k	"	"	" "	" "
R82	47	"	"	" "	" "
R83	22k	"	"	" "	" "
R84	47	"	"	" "	" "
R85	100	"	"	" "	" "
R86	220k	"	"	" "	" "
R87	220k	"	"	" "	" "
R88	100k	"	"	" "	" "
R89	100	"	"	" "	" "
R90	47	"	"	" "	Y. Amp.
R91	100	"	"	" "	" "
R92	47k	5%	2w	Elect. CJ42	" "
R93	150	5%	6w	Welwyn AW3112	" "
R94	47	"	"	" "	" "
R95	47	10%	1/4w	Dub. BTT	" "
R96	270k	"	"	" "	Trace Shifter
R97	1M	"	"	" "	" "
C1	0.1µ		500v	Dub. T.660	Y Amp
C2	3-30p			Mullard E7876	" "
C3	2-8p			Mullard E7875	" "
C4	3-30p			Mullard E7876	" "
C5	2-8p			Mullard E7875	" "
C6	470p	10%		Lemco 1510E	" "
C7	3-30p			Mullard E7876	" "
C8	3-30p			Mullard E7876	" "
C9	3-30p			Mullard E7876	" "
C10	3-30p			Mullard E7876	" "
C11	0.01µ		400v	Dub. T. 700	" "
C12	0.25µ		350v	Dub. T. 700	" "
C13	0.5µ		350v	Dub. T. 700	" "
C14	0.1µ		150v	Dub. T. 700	" "
C15	5000p	10%		Lemco 2515	" "
C16	0.1µ		350v	Dub. T. 700	" "
C17	1000p	10%		Lemco 2515	" "
C18	8µ		350v	TCC CE 16L	" "

12. COMPONENTS LIST

12.2. Trace Shifter Y Amplifier Type 741/1

Ref	Value	Tol	Rating	Manufacturer	Location
C19	10p	10%		Lemco 1106R	Trace Shifter
C20	0.1µ		150V	Dub. T700	" "
C21	10p	10%		Lemco 1106R	" "
C22	100p	10%		Lemco 1510	" "
C23	10p	10%		Lemco 1106R	" "
C24	10p	10%		Lemco 1106R	" "
C25	10p	10%		Lemco 1106R	" "
C26	100p	10%		Lemco 1510	" "
C27	10p	10%		Lemco 1106R	" "
C28	300p	10%		Lemco 1510	" "
RV1	1k			Morganite LPH	Y. Amp.
RV2	5k			Morganite U	"
RV3	200k			Morganite LPH	"
RV4	200k			Morganite LPH	Trace Shifter
RV5	200k			Morganite LPH	" "
RV6	200k			Morganite LPH	" "
D1				Mullard OA81	Trace Shifter
D2				Mullard OA81	" "
D3				Mullard OA81	" "
D4				Mullard OA81	" "
D5				Mullard OA81	" "
D6				Mullard OA81	" "
V1				Mullard ECF80	Y. Amp.
V2				Mullard ECF80	"
V3				Mullard ECF82	"
V4				Mullard ECF81	Trace Shifter
V5				Mullard ECF81	" "
V6				Mullard ECF81	" "
V7				Mullard ECF91	Y. Amp.
SWA				NSF No. 22706	Y. Amp.
SWB		V/cm		NSF No. 22705	"
SWC		Traces		NSF No. 22707	Trace Shifter
S D		Reset		Burgess V3T1	" "
SK1		Sig Input		Trans. UHF 83	Y. Amp.
PL1				McMurdo RP16	

12. COMPONENTS LIST

12.3. Beamswitch Y Amplifier Type 741/2

Ref	Value	Tol	Rating	Manufacturer	Location
R1	900k	1%	1/2w	Stc. 4304	Beamswitch
R2	110k	1%	1/2w	" 4304	"
R3	990k	1%	1/2w	" 4304	"
R4	10.1k	1%	1/2w	" 4304	"
R5	500k	1%	1/2w	" 4304	"
R6	1M	1%	1/2w	" 4304	"
R7	800k	1%	1/2w	" 4304	"
R8	250k	1%	1/2w	" 4304	"
R9	1M	1%	1/4w	" 4305	"
R10	100k	1%	1/4w	" 4305	"
R11	100	10%	1/4w	Dub BTT	"
R12	47	10%	1/4w	" BTT	"
R13	47k	5%	2w	Elect. CJ42	"
R14	47	10%	1/4w	Dub BTT	"
R15	100	10%	1/4w	" BTT	"
R16	6.8k	5%	1/2w	Stc 4304	"
R17	47	10%	1/4w	Dub BTT	"
R18	100	10%	1/4w	" BTT	"
R19	6.8k	5%	1/2w	Stc 4304	"
R20	47	10%	1/4w	Dub BTT	"
R21	100	10%	1/4w	Dub BTT	"
R22	47	10%	1/4w	Dub BTT	"
R23	47	10%	1/4w	Dub BTT	"
R24	330	10%	1/4w	Dub BTT	"
R25	330	10%	1/4w	Dub BTT	"
R26	15k	5%	3w	Welwyn AW3111	"
R27	47	10%	1/4w	Dub BTT	"
R28	100	10%	1/4w	" BTT	"
R29	47	10%	1/4w	" BTT	"
R30	100	10%	1/4w	" BTT	"
R31	47k	5%	2w	Elect. CJ42	"
R32	47k	5%	2w	" CJ42	"
R33	390k	10%	1/4w	Dub. BTT	"
R34	330k	10%	1/4w	Dub BTT	"
R35	15k	10%	1/2w	" BTA	"
R36	15k	10%	1/2w	" BTA	"
R37	47	10%	1/4w	" BTT	"
R38	47	10%	1/4w	" BTT	"
R39	100	10%	1/4w	" BTT	"
R40	330	10%	1/4w	" BTT	"
R41	390k	5%	1/2w	Stc. 4304	"
R42	900k	1%	1/2w	Stc. 4304	"
R43	110k	1%	1/2w	" 4304	"
R44	990k	1%	1/2w	" 4304	"
R45	10.1k	1%	1/2w	" 4304	"

12. COMPONENTS LIST

12.3. Beamswitch Y Amplifier Type 741/2 (cont'd)

Ref	Value	Tol	Rating	Manufacturer		Location
R46	500k	1%	1/2w	Stc.	4304	Beamswitch
R47	1M	1%	1/2w	"	4304	"
R48	800k	1%	1/2w	"	4304	"
R49	250k	1%	1/2w	"	4304	"
R50	1M	1%	1/4w	Stc.	4305	"
R51	100k	1%	1/4w	"	4305	"
R52	100	10%	1/4w	Dub.	BTT	"
R53	47	10%	1/4w	"	BTT	"
R54	47k	5%	2w	Elect.	CJ42	"
R55	47	10%	1/4w	Dub.	BTT	"
R56	100	10%	1/4w	"	BTT	"
R57	6.8k	5%	1/2w.	Stc.	4304	"
R58	6.8k	5%	1/2w	"	4304	"
R59	47	10%	1/4w	Dub	BTT	"
R60	100	10%	1/4w	"	BTT	"
R61	330	10%	1/4w	"	BTT	"
R62	47	10%	1/4w	"	BTT	"
R63	100	10%	1/4w	"	BTT	"
R64	47	10%	1/4w	"	BTT	"
R65	47	10%	1/4w	"	BTT	"
R66	330	10%	1/4w	"	BTT	"
R67	15k	5%	3w	Welwyn	AW3111	"
R68	47	10%	1/4w	Dub.	BTT	"
R69	100	10%	1/4w	Dub.	BTT	"
R70	47	10%	1/4w	"	BTT	"
R71	100	10%	1/4w	"	BTT	"
R72	160k	5%	1/2w	Stc.	4304	"
R73	120k	5%	1/2w	"	4304	"
R74	47	10%	1/4w	Dub	BTT	"
R75	100	10%	1/4w	"	BTT	"
R76	47	10%	1/4w	"	BTT	"
R77	47	10%	1/4w	"	BTT	"
R78	100	10%	1/4w	"	BTT	"
R79	47	10%	1/4w	"	BTT	"
R80	1.2k	10%	1/4w	"	BTT	"
R81	1.2k	10%	1/4w	"	BTT	"
R82	150k	10%	1/4w	"	BTT	"
R83	15k	10%	1/4w	"	BTT	"
R84	15k	10%	1/4w	"	BTT	"
R85	150k	10%	1/4w	"	BTT	"
R86	10k	10%	1/4w	"	BTT	"
R87	10k	10%	1/4w	"	BTT	"
R88	220k	10%	1/4w	"	BTT	"
R89	47	10%	1/4w	"	BTT	"
R90	100	10%	1/4w	"	BTT	"

12. COMPONENTS LIST

12.3. Beamswitch Y Amplifier Type 741/2 (cont'd)

Ref	Value	Tol	Rating	Manufacturer	Location
R91	47k	10%	1/2w	Dub. BTA	Beamswitch
R92	1.5M	10%	1/4w	" BTT	"
R93	22	5%	6w	Welwyn AW3112	"
R94	22	5%	6w	" "	"
R95	47	5%	6w	" "	"
C1	0.1µ		500V	Dub. T660	Beamswitch
C2	2-8p			Mullard E7875	"
C3	3-30p			Mullard E7876	"
C4	2-8p			Mullard E7875	"
C5	3-30p			Mullard E7876	"
C6	470p	10%	350V	Lemco 1510E	"
C7	3-30p			Mullard E7876	"
C8	3-30p			Mullard E7876	"
C9	3-30p			Mullard E7876	"
C10	3-30p			Mullard E7876	"
C11	0.01		400V	Dub. 700	"
C12	0.1µ		350V	" 700	"
C13	0.1µ		350V	" 700	"
C14	5000p	10%	350V	Lemco 2515	"
C15	0.01µ		400V	Dub. 700	"
C16	0.1µ		500V	Dub. 660	"
C17	2-8p			Mullard E7875	"
C18	3-30p			Mullard E7876	"
C19	2-8p			Mullard E7875	"
C20	3-30p			Mullard E7876	"
C21	470p	10%	350V	Lemco 1510E	"
C22	3-30p			Mullard E7876	"
C23	3-30p			Mullard E7876	"
C24	3-30p			" E7876	"
C25	3-30p			" E7876	"
C26	0.01µ		400V	Dub. 700	"
C27	0.1µ		350V	Dub. 700	"
C28	0.1µ		350V	Dub. 700	"
C29	0.5µ		350V	Dub. 700	"
C30	220p	10%	350V	Lemco 1510	"
C31	220p	10%	350V	Lemco 1510	"
C32	50p	10%	350V	Lemco 1106R	"
C33	50p	10%	350V	Lemco 1106R	"
C34	1.5-8p	10%		Lemco Vert Mtg.	"
C35	1.5-8p			" Vert Mtg.	"
C36	1.5-8p			Vert Mtg.	"
C37	1.5-8p			" Vert Mtg.	"
C38	0.1µ		350V	Dub. 700	"

12. COMPONENTS LIST

12.3. Beamswitch Y Amplifier Type 741/2 (cont'd)

Ref	Value	Tol	Rating	Manufacturer	Location
RV1	1k			Morganite LPH	Beamswitch
RV2	5k			" U	"
RV3	5k			" U	"
RV4	1k			" LPH	"
RV5	200k			" LPH	"
D1				Mullard OA81	"
D2				" OA81	"
D3				" OA81	"
V1				Mullard ECF80	"
V2				" ECC81	"
V3				" ECF80	"
V4				" ECF80	"
V5				" ECF80	"
V6				" ECF80	"
V7				" ECC81	"
V8				" ECC82	"
V9				" ECC81	"
SWA	Sig.Input 1			NSF No.22706	"
SWB	" " 2			NSF No.22706	"
SWC	V/cm			NSF No.22705	"
SWD	V/cm			NSF No.22705	"
SWE	CH1-CH2			NSF No.22708	"
SWF	Int.Trig.			NSF No.22704	"
SK1				Trans.Radio UHA83	"
SK2				Trans.Radio UHA83	"
PL1				McMurdo RP16	"

12.4. Single Ended Y Amplifier Type 741/3

Ref	Value	Tol	Rating	Manufacturer	Location
R1	900k	1%	1/2w	Stc. 4304	Y Amp.
R2	110k	1%	1/2w	" 4304	"
R3	990k	1%	1/2w	" 4304	"

12. COMPONENTS LIST

12.4. Single Ended Y Amplifier Type 741/3

Ref	Value	Tol	Rating	Manufacturer	Location
R4	10.1k	1%	1/2w	Stc. 4304	Y. Amp.
R5	500k	1%	1/2w	" 4304	"
R6	1M	1%	1/2w	" 4304	"
R7	800k	1%	1/2w	" 4304	"
R8	250k	1%	1/2w	" 4304	"
R9	1M	1%	1/4w	" 4305	"
R10	100k	1%	1/4w	" 4305	"
R11	100	10%	1/4w	Dub. BTT	"
R12	47	10%	1/4w	" BTT	"
R13	470	10%	1/4w	" BTT	"
R14	39k	5%	2w	Elect. CJ42	"
R15	100	10%	1/4w	Dub. BTT	"
R16	6.8k	5%	1/2w	Stc. 4304	"
R17	47	10%	1/4w	Dub. BTT	"
R18	47	10%	1/4w	" BTT	"
R19	47	10%	1/4w	" BTT	"
R20	330	10%	1/4w	" BTT	"
R21	8.2k	5%	5w	Welwyn AW3111	"
R22	6.8k	5%	5w	" AW3111	"
R23	6.8k	5%	1/2w	Stc. 4304	"
R24	47	10%	1/4w	Dub BTT	"
R25	100	10%	1/4w	" BTT	"
R26	330	10%	1/4w	" BTT	"
R27	750k	5%	1/2w	Stc. 4304	"
R28	Not Used				
R29	910	5%	1/2w	Stc. 4304	Y. Amp.
R30	100	10%	1/4w	Dub. BTT	"
R31	47	10%	1/4w	" BTT	"
R32	47k	5%	2w	Elect. CJ42	"
R33	100	10%	1/4w	Dub. BTT	"
R34	47	10%	1/4w	" BTT	"
R35	47k	5%	2w	Elect. CJ42	"
R36	390k	10%	1/4w	Dub. BTT	"
R37	330k	10%	1/4w	" BTT	"
R38	15k	10%	1/4w	" BTT	"
R39	15k	10%	1/4w	" BTT	"
R40	47	10%	1/4w	" BTT	"
R41	47	10%	1/4w	" BTT	"
R42	100	10%	1/4w	" BTT	"
R43	330	10%	1/4w	" BTT	"
R44	47k	10%	1/4w	" BTT	"
R45	39k	10%	1/4w	" BTT	"
R90	47	10%	1/4w	" BTT	"
R91	100	10%	1/4w	" BTT	"
R92	47k	5%	2w	Elect. CJ42	"
R93	22	5%	6w	Welwyn AW3112	"

12. COMPONENTS LIST

12.4. Single Ended Y Amplifier Type 741/3

Ref	Value	Tol	Rating	Manufacturer	Location
R94	22	5%	6w	Welwyn AW3112	Y.Amp.
R95	47	5%	6w	" "	"
R96	47	10%	1/4w	Dub BTT	"
C1	0.1µ		500V	Dub T660	Y. Amp.
C2	3-30p			Mullard E7876	"
C3	2-8p			Mullard E7875	"
C4	3-30p			Mullard E7876	"
C5	2-8p			Mullard E7875	"
C6	470p	10%		Lemco 1510E	"
C7	3-30p			Mullard E7876	"
C8	3-30p			Mullard E7876	"
C9	3-30p			Mullard E7876	"
C10	3-30p			Mullard E7876	"
C11	0.01µ		400V	Dub T700	"
C12	0.25µ		350V	Dub T700	"
C13	0.5µ		350V	Dub T700	"
C14	0.1µ		150V	Dub T700	"
C15	5000p	10%		Lemco 2515	"
C16	0.1µ		350V	Dub T700	"
C17	1000p	10%		Lemco 2515	"
C18	8µ		350V	T.C.C. CE16L	"
RV1	1k			Morganite LPH	Y. Amp.
RV2	5k			Morganite U	"
RV3	200k			Morganite LPH	"
V1				Mullard ECF80	Y. Amp.
V2				Mullard ECF80	"
V3				Mullard ECF82	"
V7				Mullard ECF91	"
SWA				NSF No. 22706	Y. Amp.
SWB		V/cm		NSF No. 22705	"
SK1		Sig. Input		Trans. UHF83	Y. Amp.
PL1				McMurdo RP16	Y. Amp.

12. COMPONENTS LIST

12.5. Probe Type 741/6

Ref	Value	Tol	Rating	Manufacturer	Location
R1	9M	1%	1/4w	Radio Resistor Co.	Probe
C1	3.5-12p			T.C.C. Ltd.	Probe.

REMSCOPE type 741

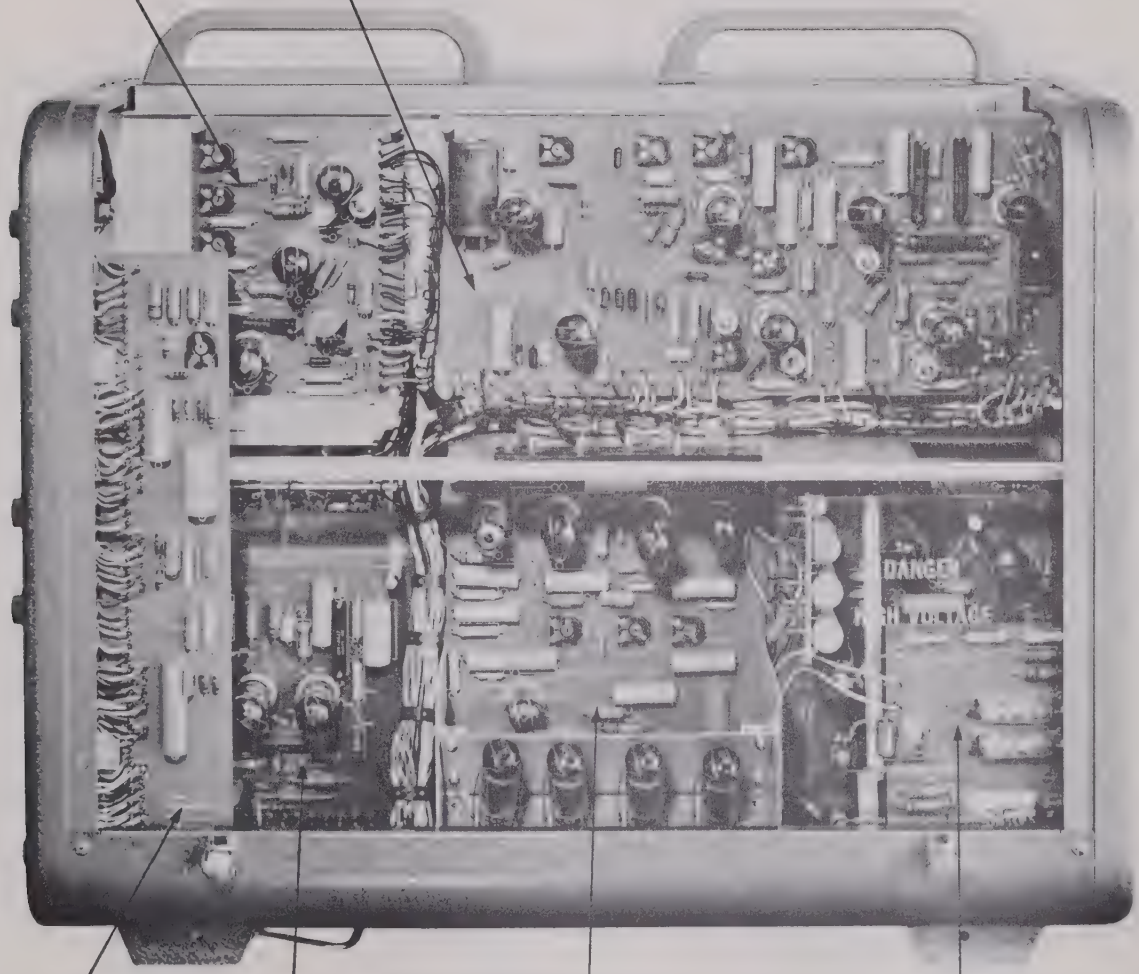


FIG. 1.

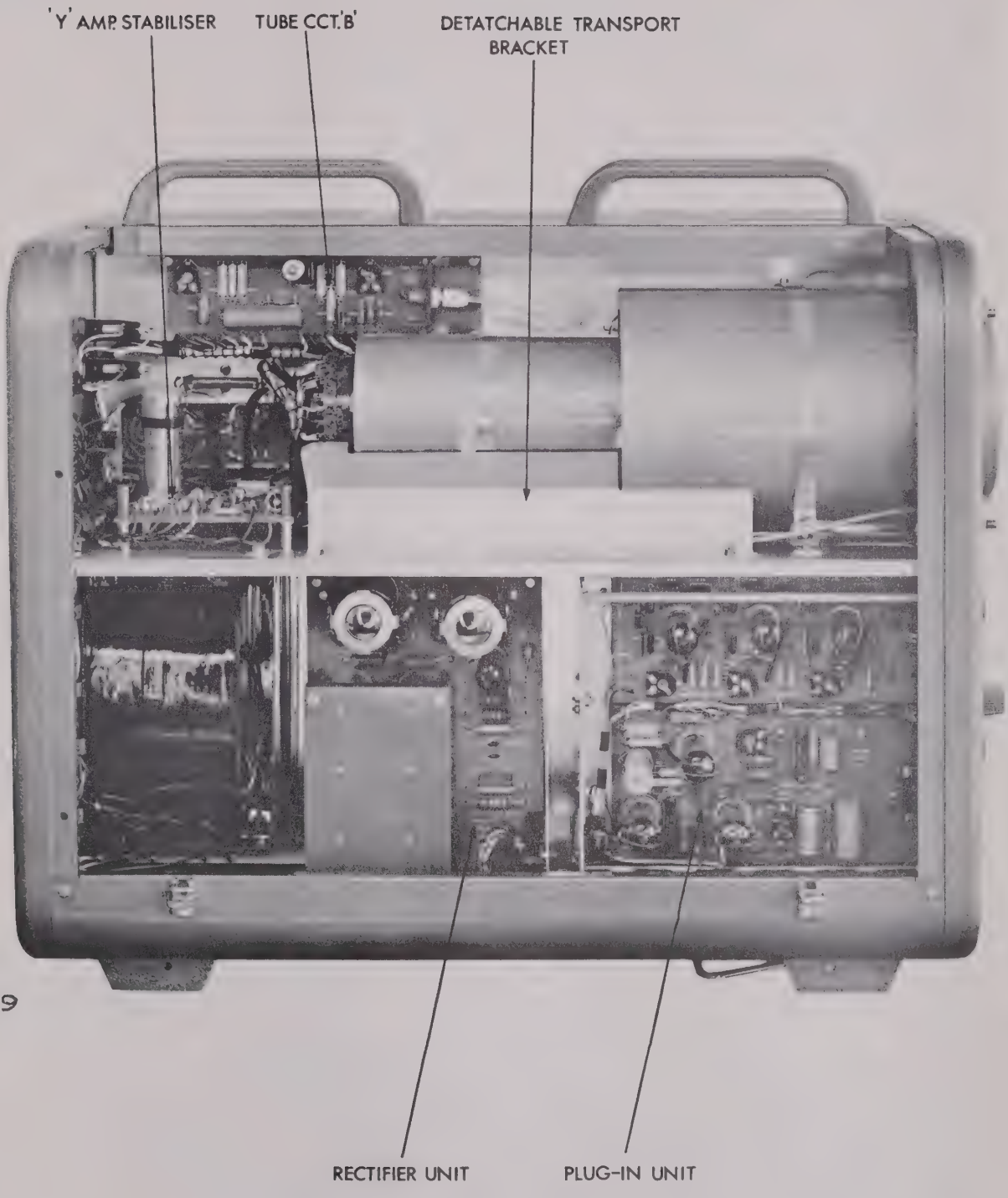
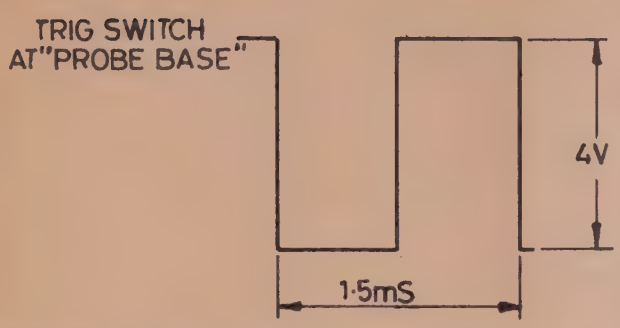

'Y' AMP. STABILISER
TUBE CCT.'B'
DETATCHABLE TRANSPORT BRACKET
70419
RECTIFIER UNIT
PLUG-IN UNIT

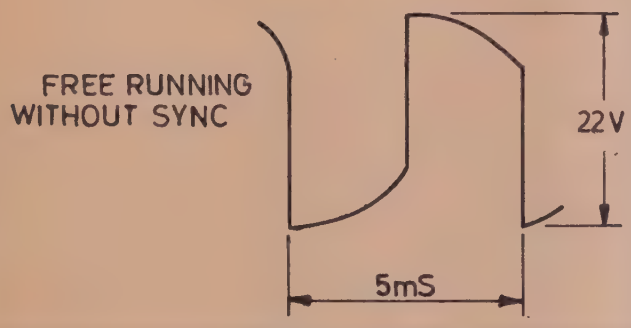
FIG. 3.

PROBE TEST SOCKET

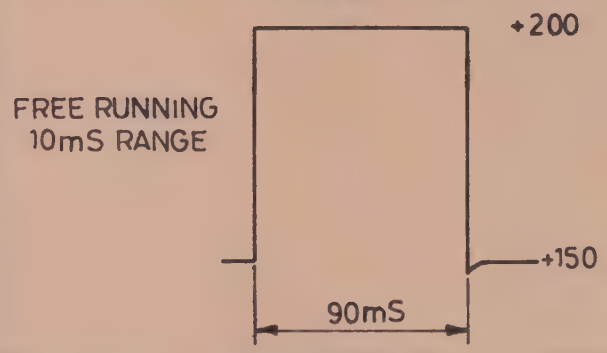


CATHODE V27a

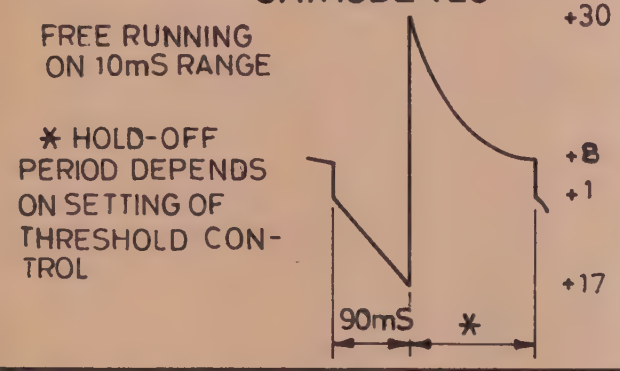
ANODE V24b



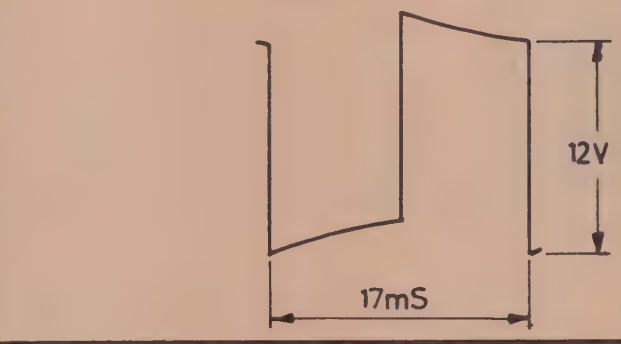
CATHODE V27b



CATHODE V25

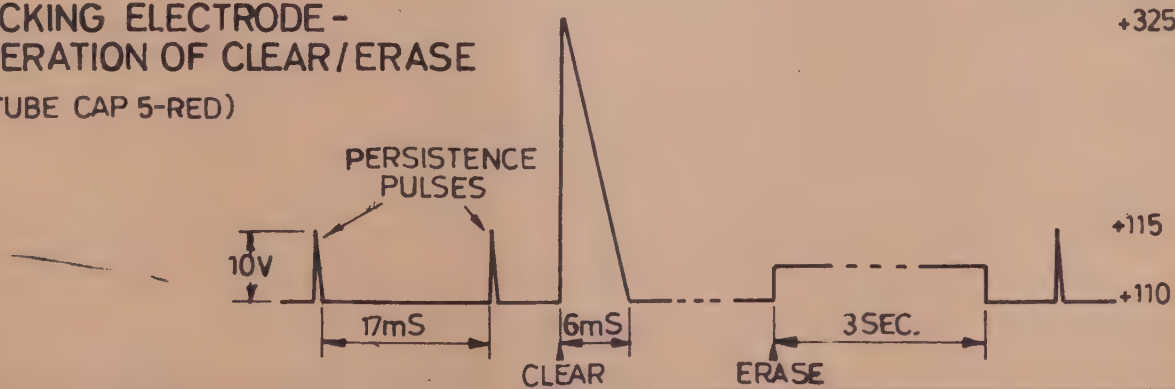


ANODE V22a



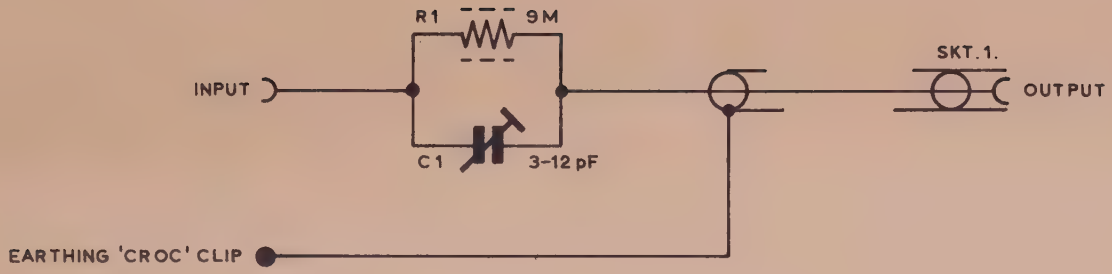
BACKING ELECTRODE - OPERATION OF CLEAR/ERASE

(TUBE CAP 5-RED)



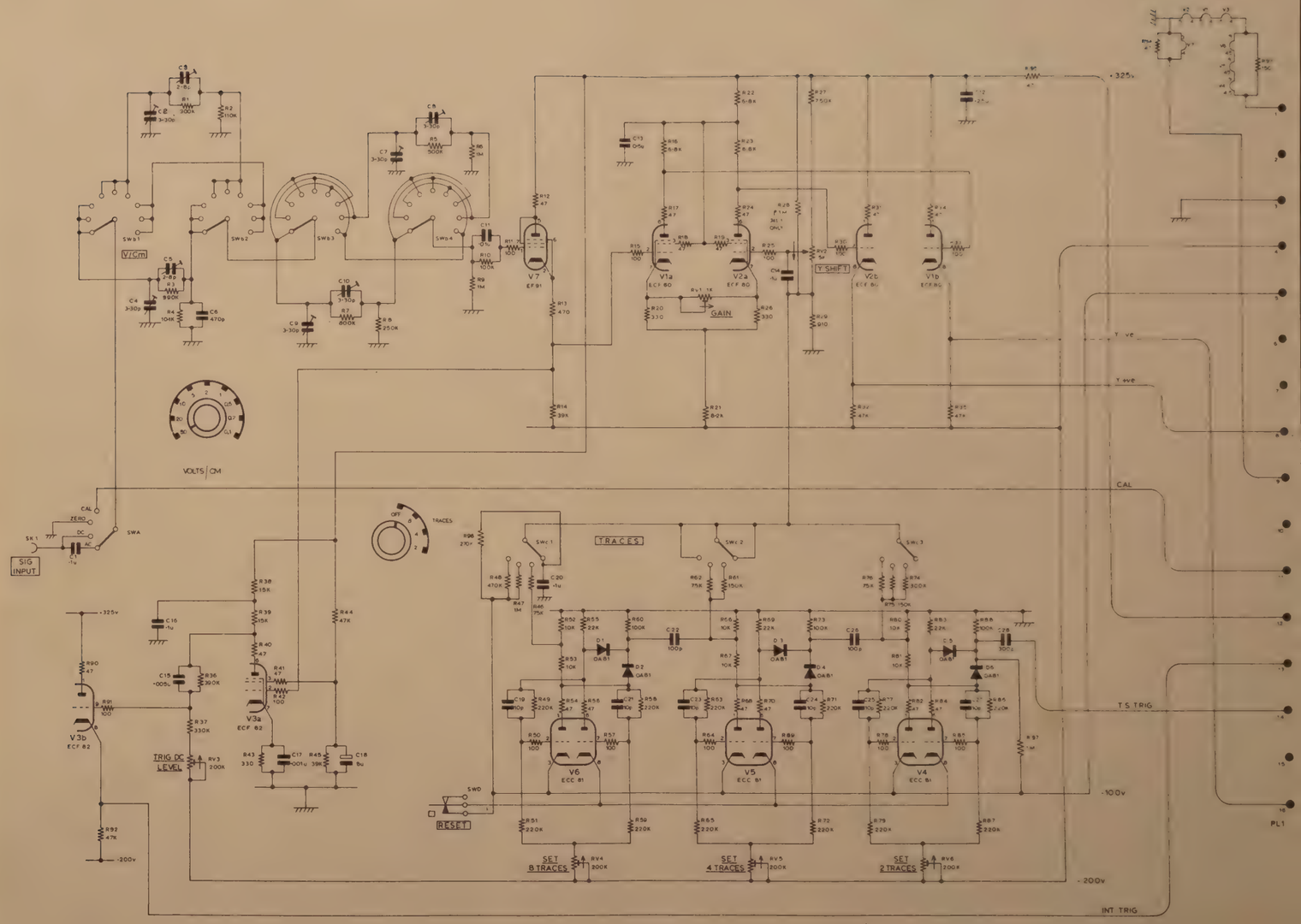
TYPICAL WAVEFORMS
TYPE 741

D22723



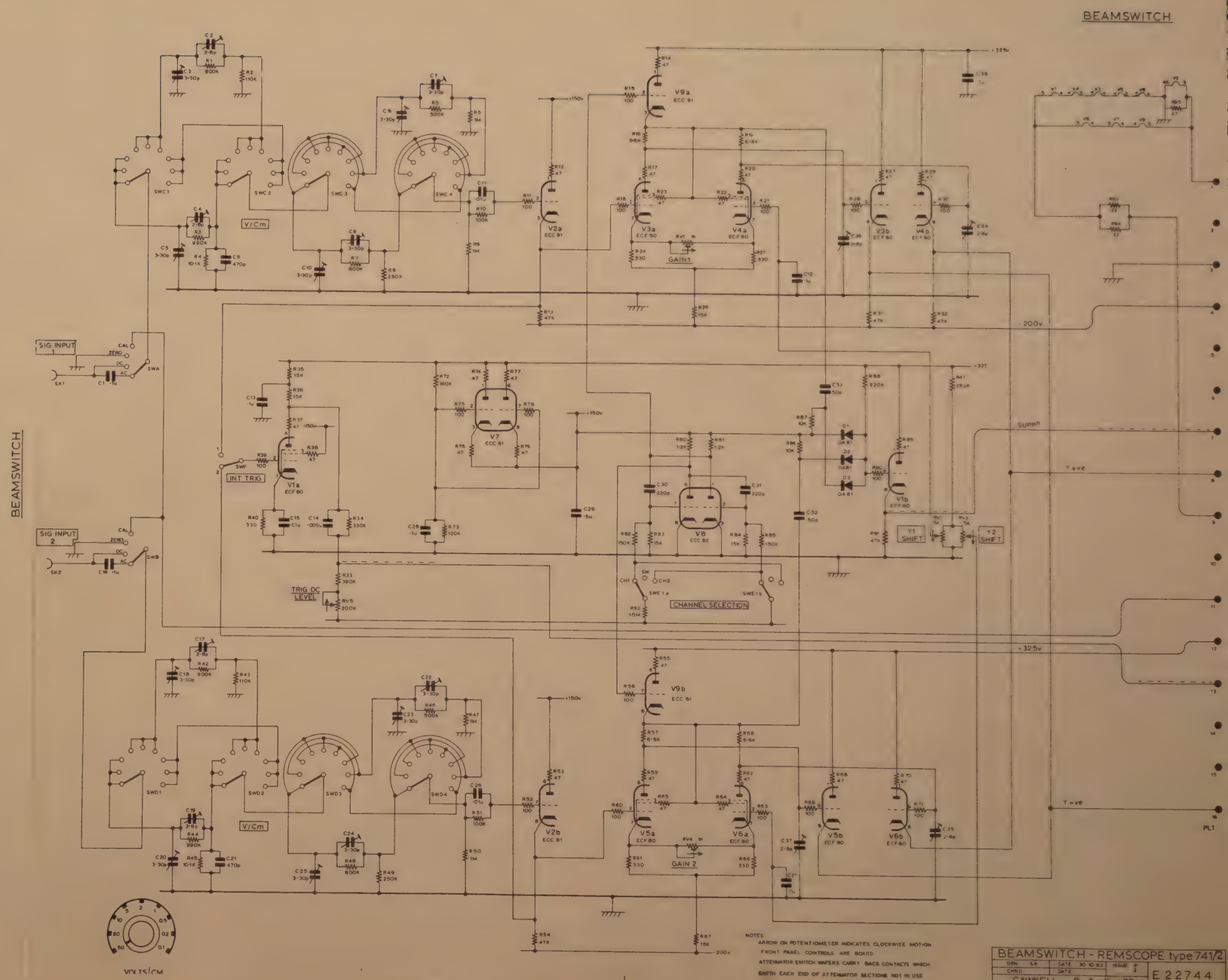
CAWKELL RESEARCH AND ELECTRONICS LTD LONDON ENGLAND				
DATE	24.8.62.		CIRCUIT DIAGRAM OF :-	DRG Nº
DRN	R.C.B.		PROBE type 740/2 741/6	22 501. CD.
CHECK'D	J.R.B.			
APP'D				

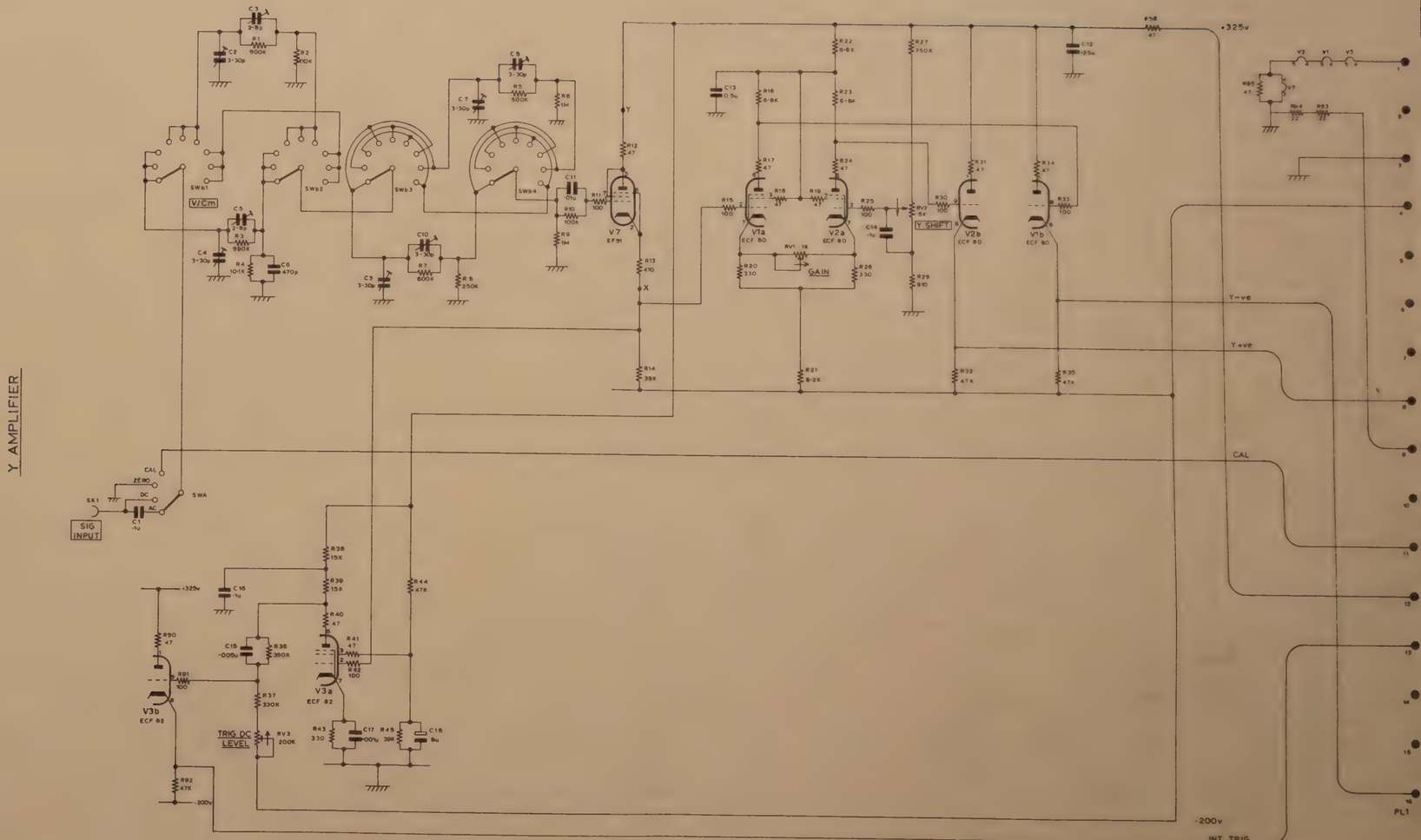
Y AMP - TRACE SHIFTER



NOTES
ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION
FRONT PANEL CONTROLS ARE BOXED

Y AMP-TRACE SHIFTER-REMSCOPE type 741				
DRN	S.B	DATE	12.10.62	ISSUE 1
CHK'D		DATE		
CAWKELL R & E LTD				E 22743


BEAMSWITCH
SIG INPUT 1
SIG INPUT 2
CAL
ZERO
DC
AC
SWA
SWB
SK1
SK2
V/Cm
INT TRIG
TRIG DC LEVEL
GAIN 1
GAIN 2
CHANNEL SELECTION
Y1 SHIFT
Y2 SHIFT
+325v
+150v
-200v
SUPPN
Y+ve
Y-ve
PL1
VOLTS/CM
NOTES
ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION
FRONT PANEL CONTROLS ARE BOXED
ATTENUATOR SWITCH WAFERS CARRY BACK CONTACTS WHICH EARTH EACH END OF ATTENUATOR SECTIONS NOT IN USE
BEAMSWITCH - REMSCOPE type 741/2
CAWKELL R & E LTD
E 22744



NOTES

ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION

FRONT PANEL CONTROLS ARE BOXED

ATTENUATOR WAFERS CARRY BACK CONTACTS WHICH EARTH EACH END OF ATTENUATOR SECTIONS NOT IN USE.

Y AMPLIFIER REMSCOPE type 741/3			
DRN SB	DATE 23 10 63	ISSUE 2	
CHKD	DATE	Les Wigford	3
CAWKELL R & E LTD			E 22742

MAIN CHASSIS

MAIN CHASSIS

-45v
6·3v(+100v)
0v
-200v
-100v
'Z' MOD
SUPPN.
Y -ve
+45v
6·3v(+100v)
CAL.
+325
INT. TRIG
T.S. TRIG
EXT SWEEP
Y -ve

EXT SWEEP
Term 2
X GAIN
X SHIFT
X ASTIG
V28b ECF 82
V29b ECF 82
V19a ECF 80
V20a ECF 80
Y ASTIG
COLEN
FOCUS
V31 E 70 2A
STORE
READ
Clear
Erase
FLOOD
BACKGROUND
ERASE AMPL
V19b ECF 80
V21a ECF 82
V22 ECC 81
PP LEN
PP AMPL
V20b ECF 80
V21b ECF 82
SET +200v
PL3 SK3
·7Kv
+325v
+200v
·100v
0v
-200v
·800v
-1600v

PROBE TEST
INT
EXT
SK2
TRIG SYNC
SK1
V23a ECF 82
V24a ECF 82
V23b ECF 82
V24b ECF 82
TRIG LEVEL
PROBE TEST
SK4
SWEEP TIME cm
V25 ECC 81
V25a ECC 83
V26b ECC 83
V27 ECC 81
V26a ECC 83
V29a ECF 82
V28a ECF 82
V30 ECC 81
SWEEP THRESHOLD
SET V26a
SET 1 10 100 & SET 100ms SET 1s
1 10ms
SET LEVEL
SW AMPL
Bu LEVEL
SET Bu
BEAM CUTOFF
Prime
L/O
Normal
SWEEP SCREEN
DC
AC
Free
Term 1
Term 3
GATE OUT
+325v
+200v
0v
-200v
-350v

NOTES -
ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION
FRONT PANEL CONTROLS ARE BOXED

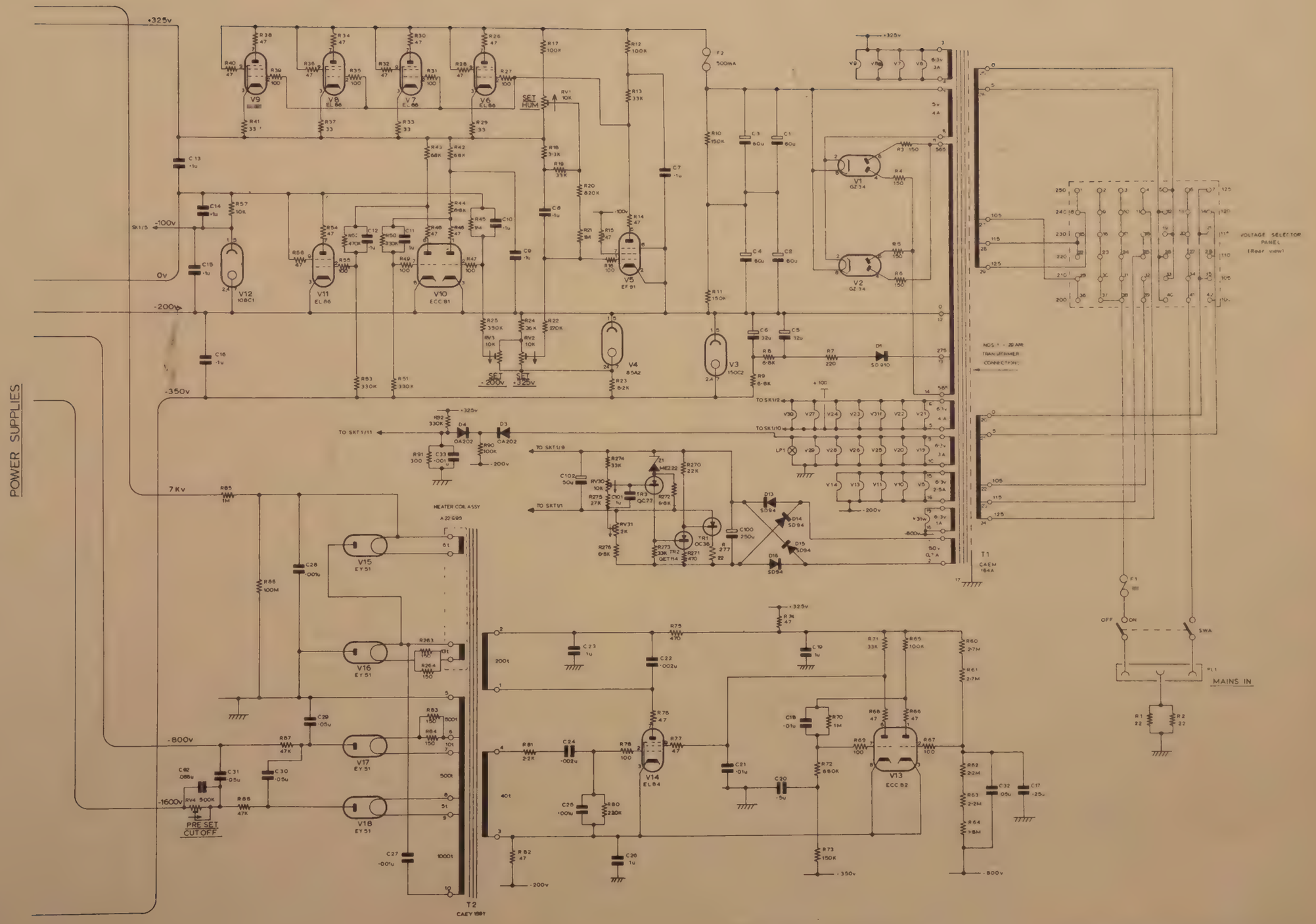
1555	CN 806	(C35 R162) 13.8.63

MAIN CHASSIS — REMSCOPE type 741

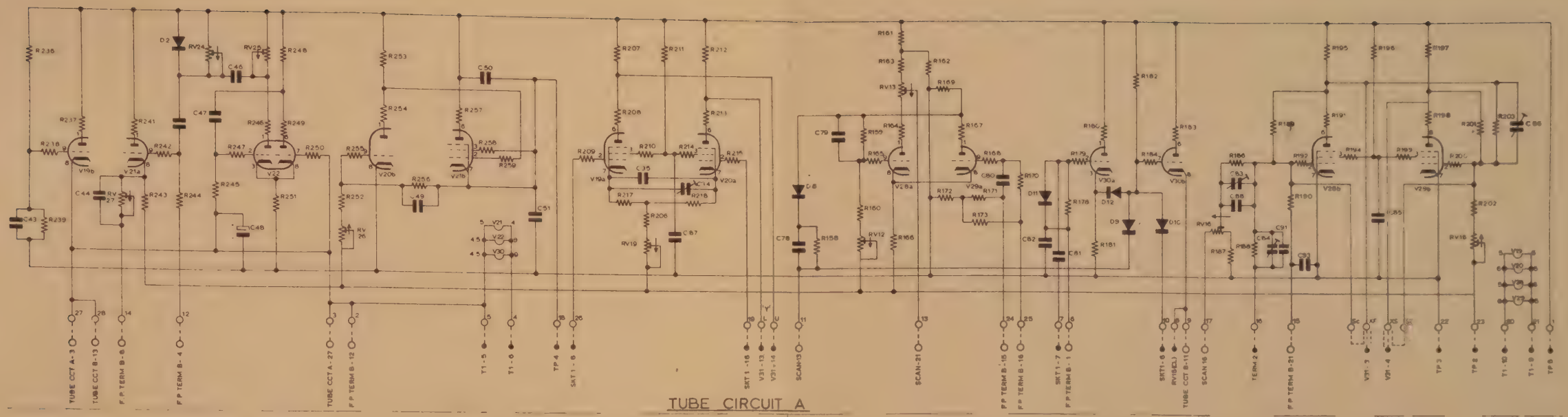
DWN. SB DATE 16 8 62
TRD. DATE
APP. DATE 26/10/62 & 17.9.

CAWKELL R & E LTD

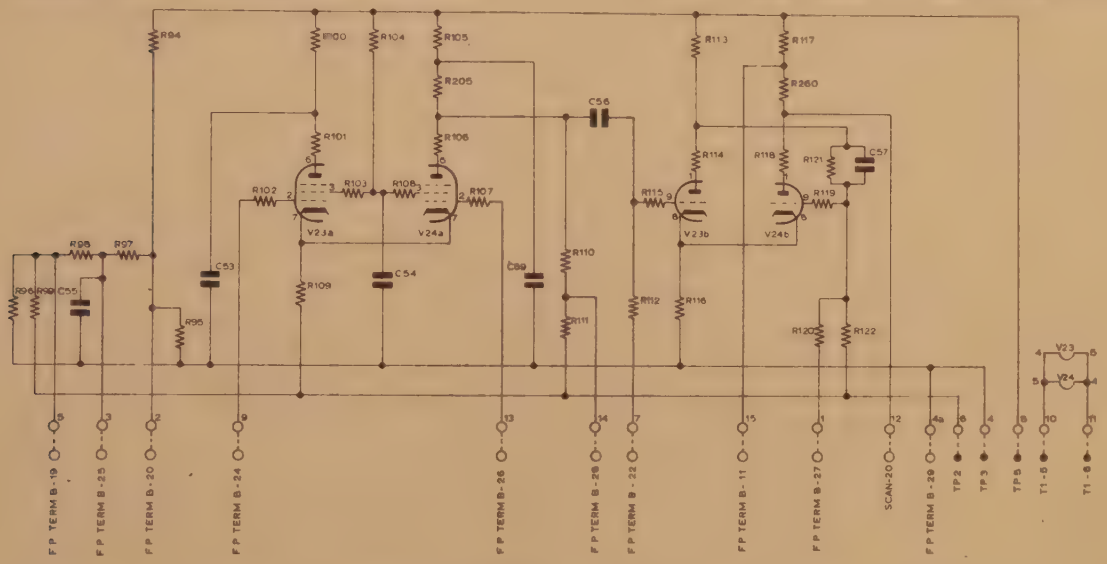
E 22740



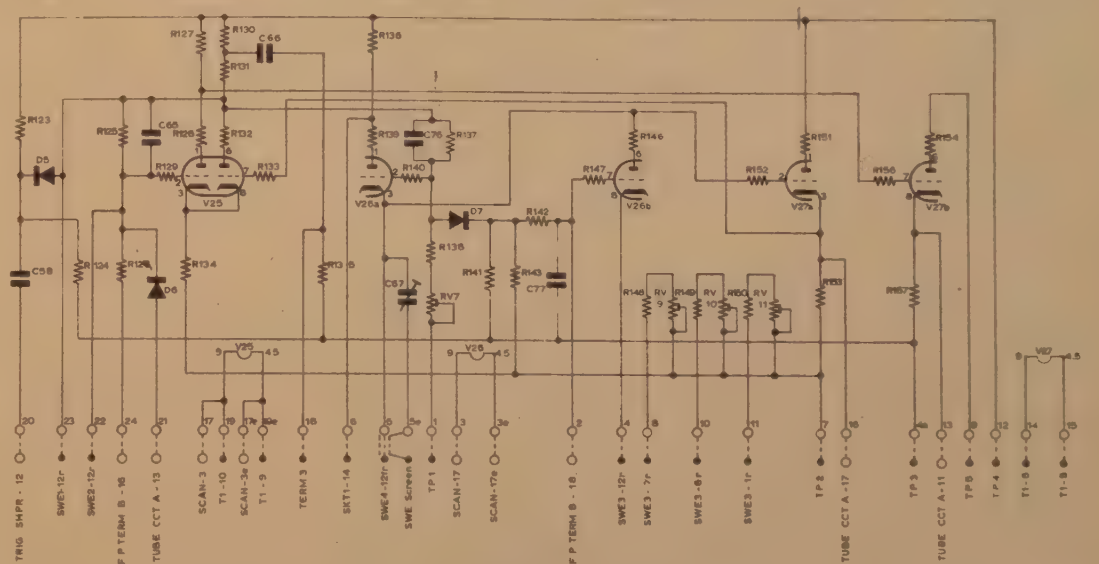
POWER SUPPLIES – REMSCOPE type 741			
DRN SB	DATE 8 10 62	ISSUE 2	
CHKD	DATE	DRG. NO.	E 22741
CAWKELL R & E LTD			



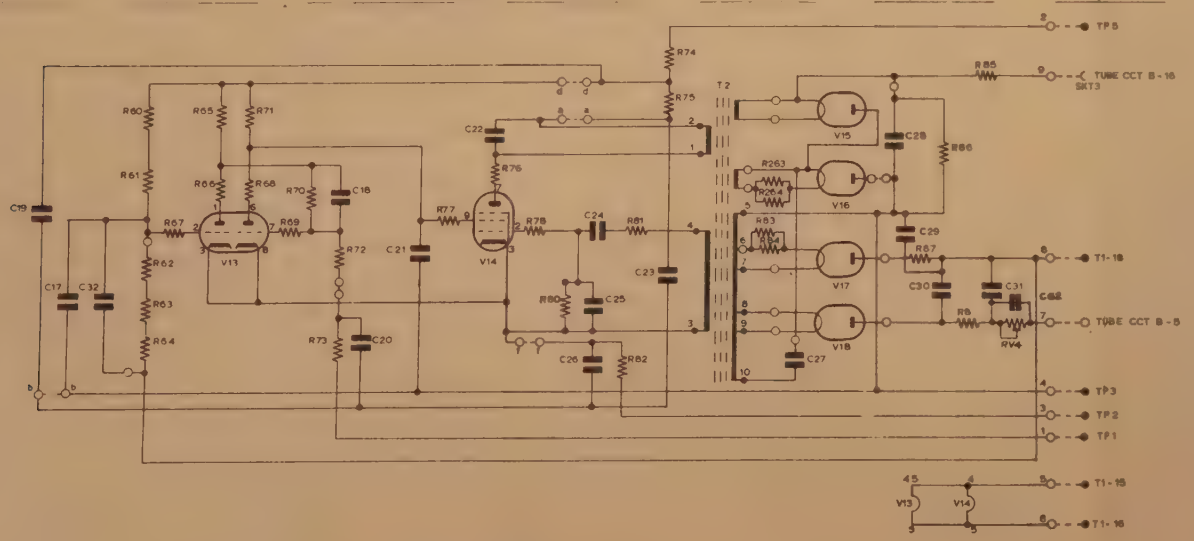
TUBE CIRCUIT A



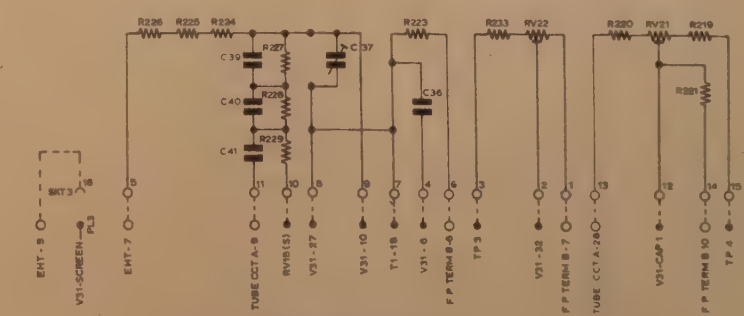
TRIGGER SHAPER



SCAN GEN



E.H.T.

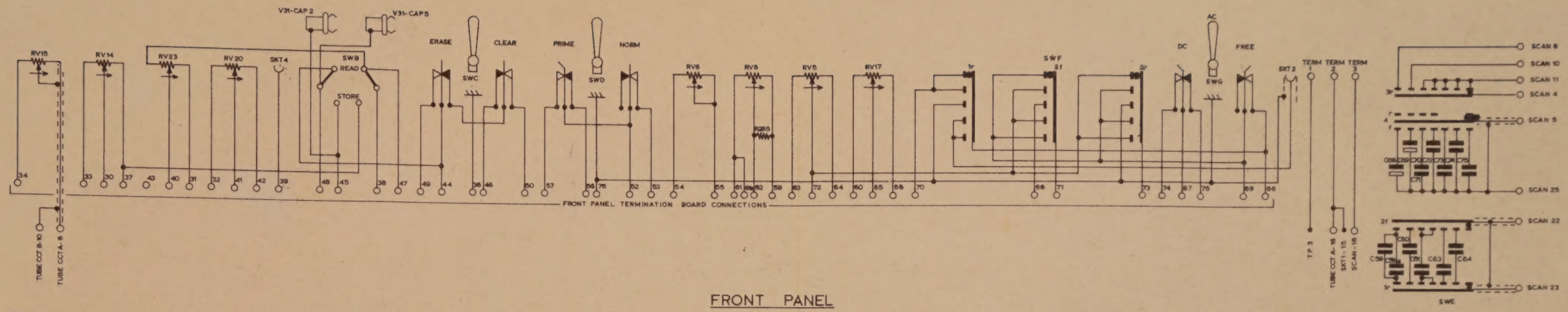


TUBE CIRCUIT B

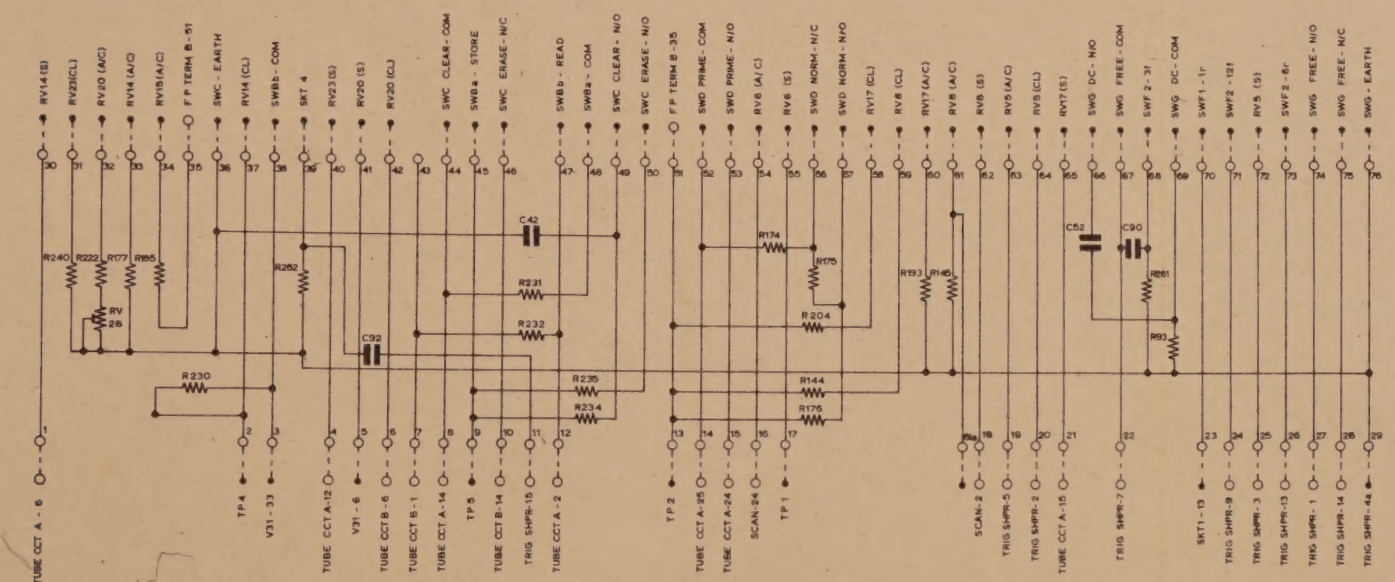
NOTES
ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION
— DENOTES EYELET CONNECTION
— DENOTES HARNESS
— DENOTES SOLDER CONNECTION

FOR FULL COMPONENT DETAILS SEE MAIN CHASSIS & POWER SUPPLIES CIRCUIT DIAGRAMS

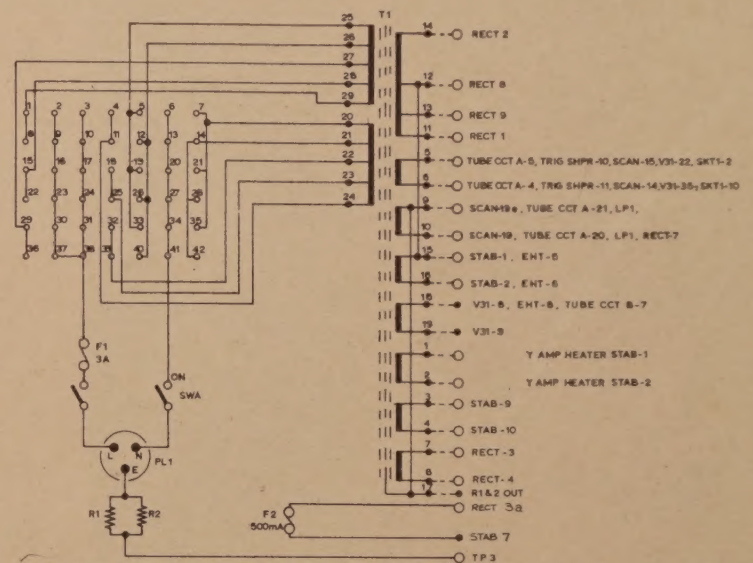
CIRCUIT INTERCONNECTION DIAGRAM			
DRN SB	DATE 6 11 82	ISSUE 1	E 22746
CHKD	DATE	[illegible]	SHEET 1 of 2 shts
CAWKELL R & E LTD			



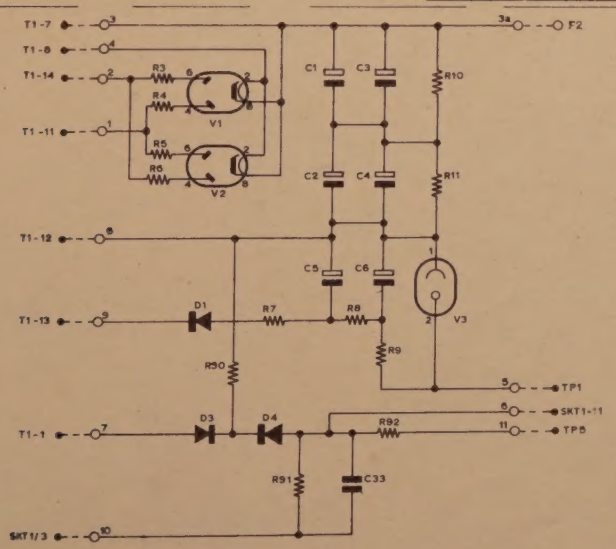
FRONT PANEL



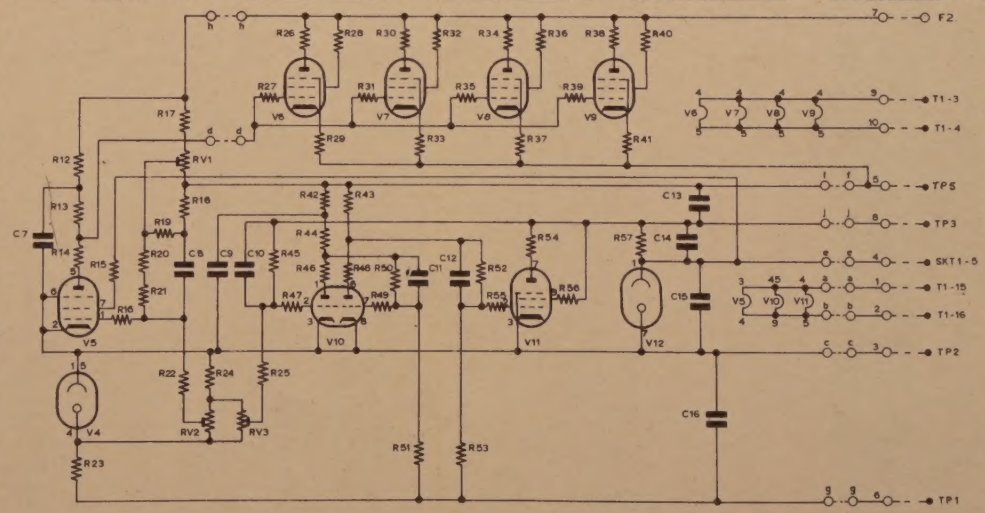
FRONT PANEL TERMINATION BOARD



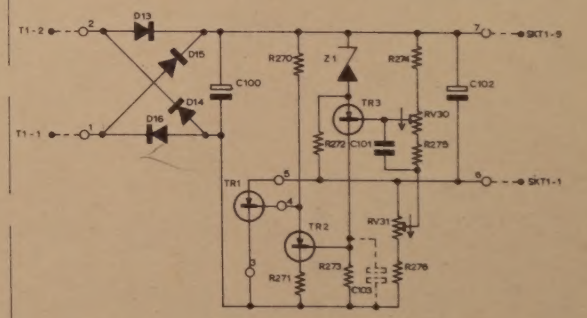
MAINS INPUT PANEL & MAINS TRANSFORMER



RECTIFIER



STABILISER



Y AMP. HEATER STABILISER

NOTES

ARROW ON POTENTIOMETER INDICATES CLOCKWISE MOTION

○ — DENOTES EYELET CONNECTION

| — DENOTES HARNESS

● — DENOTES SOLDER CONNECTION

FOR FULL COMPONENT DETAILS SEE MAIN CHASSIS & POWER SUPPLIES CIRCUIT DIAGRAMS

CIRCUIT INTERCONNECTION DIAGRAM			
DRN SB	DATE 15.11.62	ISSUE 1	E 22746
CHKD	DATE	ex Fig 83 #3 (2462)	SHEET 2 of 2 shts
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